Peer reviewed article

Interferential current versus biofeedback results in urinary stress incontinence

Funda Demirtürk[a], *Türkan Akbayrak*[b], *İlkim Çitak Karakaya*[c], *İnci Yüksel*[b], *Nuray Kirdi*[b], *Fazlı Demirtürk*[d], *Serap Kaya*[a], *Ali Ergen*[a], *Sinan Beksac*[f]

[a] Gaziosmanpaşa University, School of Physical Education and Sports
[b] Hacettepe University, Faculty of Health Science , Department of Physical Therapy and Rehabilitation, Women's Health Unit, Samanpazarı, Ankara, Turkey
[c] Mugla University, Muğla School of Health Sciences, Department of Physiotherapy and Rehabilitation, Muğla, Turkey
[d] Gaziosmanpaşa University, Obstetrics and Gynaecology
[e] Hacettepe University, Department of Urology
[f] Hacettepe University, Department of Obstetrics and Gynaecology

Abstract

Background: Urinary stress incontinence is a common, disruptive and potentially disabling condition in which the subject complains of involuntary leakage on effort or exertion or on sneezing or coughing.

Aim: This study was performed in order to compare the effects of interferential current and biofeedback applications on incontinence severity in patients with urinary stress incontinence.

In addition, pelvic muscle strength and quality of life as important parameters in these subjects were investigated.

Methods: In this prospective, randomised, controlled study, forty women with moderate intensity of urinary stress incontinence as determined by one-hour pad test were included. Pelvic muscle strength was evaluated by a biofeedback device and quality of life was assessed by a 28-itemed questionnaire. All of the parameters were evaluated before and after the treatments. Twenty cases underwent interferential current therapy, while pelvic floor exercises via biofeedback were applied in the remaining cases. The treatments lasted 15 minutes per session, three times a week for a total of 15 sessions.

Results: All of the parameters improved after the treatments in each group ($p < 0.05$) and both treatment modalities seemed to have similar effects on pad test (95% CI: –1.48 – 4.59), pelvic muscle strength (95% CI: –9.29 – 1.78) and quality of life (95% CI: –11.91 – 5.31) outcomes.

Conclusions: Physical therapy modalities used in this trial are applied easily and non invasive. Also, when the finding that no adverse effects were observed during the study period is taken into consideration, it can be concluded that both methods can be used effectively in patients with urinary stress incontinence.

Key words: urinary stress incontinence; interferential current; biofeedback; pelvic floor exercises; quality of life

Introduction

Urinary stress incontinence (USI) is defined as the complaint of involuntary leakage on effort or exertion, or on sneezing or coughing [1].

Pelvic floor muscle weakness plays an important role in USI aetiology [2, 3]. Pelvic floor muscles work to support the bladder neck in the intra-abdominal cavity and maintain urinary continence. Weakness of these muscles leads the bladder to shift to the extra-abdominal cavity and thus a change in the urethra-vesicle angle occurs. As a result, the result of intra-abdominal pressure changes is to open the bladder neck rather than to close it thus causing urinary incontinence when intra-abdominal pressure is increased [2–5].

USI may affect the quality of life adversely and may lead to psycho-social problems such as depression, social isolation, reduced self-confidence and other related health problems [6, 7].

In addition to medical and surgical approaches, physical therapy and rehabilitation procedures play important role in the treatment of USI. The aim of treatment focuses on

No financial support declared.

strengthening weak pelvic floor muscles in order to increase the low urethral closure pressure, thus eliminating incontinence and improving quality of life. Therefore, pelvic floor re-education methods including Kegel exercises, biofeedback (BF), electrical stimulation, vaginal cones and bladder training can be used in the treatment of this problem [3–5, 8].

BF offers the patient the chance to manipulate electro-physical responses of his/her pelvic floor muscles according to visual and auditory signals. Most women are not aware of how their pelvic floor muscles work. BF is used especially to teach muscle functions and to check if the exercises are performed correctly [3, 9].

Reports of incontinence therapy by electrical stimulation are to be found in the literature since 1963 [4, 10–12]. Electrical stimulation aims to improve the urethral closure pressure by restoration of reflex activation of the pelvic floor muscles, maintaining synchronised contraction of these muscles in addition to the strengthening effect [4].

Interferential current (IC) as one of the medium frequency currents, is commonly used in the treatment of USI. IC can be applied with two or four electrodes and effective low frequency occurs in that area where the medium frequencies intersect within the pelvis to stimulate the pelvic floor. Ease of usage and external application without giving harm to the superficial tissues are the main advantages of this method. The current produces positive responses in the body and the intensity is well tolerated by the patients [3, 4, 13, 14].

In the literature, although a great deal of knowledge exists about the use and effectiveness of physical therapy, there are only a limited number of studies about the comparison of different physical therapy methods in USI. The aim of this study is to compare the results of IC and BF and to investigate if these two modalities have similar effects on incontinence severity, pelvic muscle strength and quality of life in patients with USI.

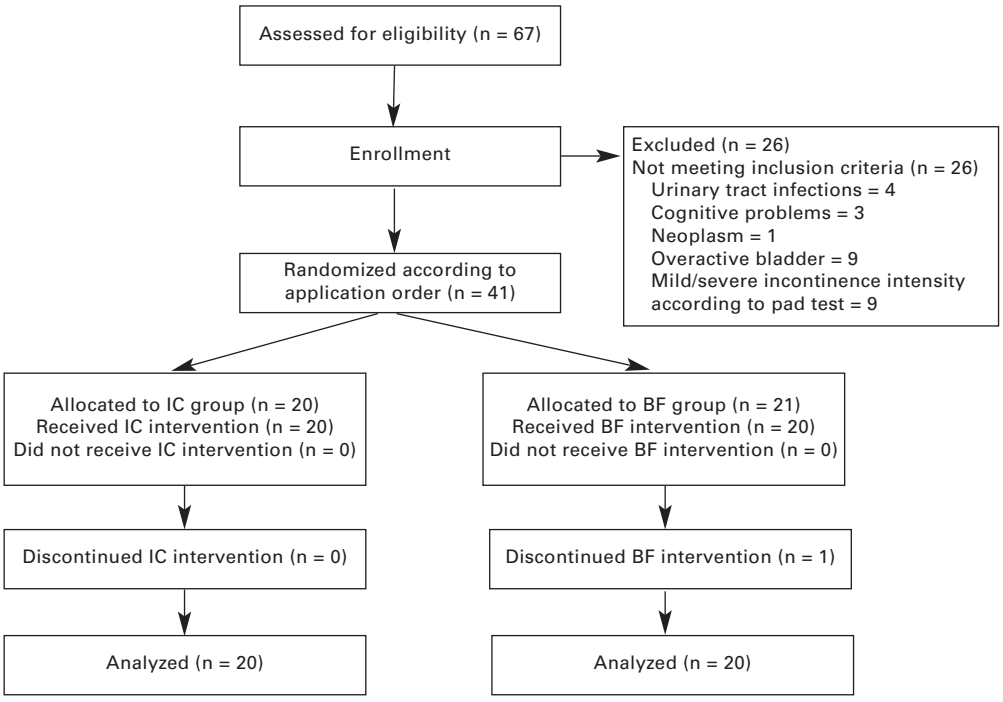
Materials and methods

This prospective randomised and controlled study, which aimed to compare the results of different physiotherapy techniques in patients with USI, was approved by the Hacettepe University, Ethics Committee of the Faculty of Medicine, and supported by the Scientific Research Centre of the same university (project number: 998 02 401 002).

The cases were diagnosed as urinary stress incontinence by an urologist and a gynaecologist and referred to Hacettepe University, School of Physical Therapy and Rehabilitation, Women's Health Unit, between the years 1998–2005. Diagnosis was made according to the detailed history, clinical and physical examinations and urodynamic tests (MMS UD 2000 B.V. Netherlands). Among 67 cases referred as having USI, those with urinary tract infections, detrusor over activity, cognitive problems and neoplasm were excluded, and those with moderate intensity of incontinence as determined by a one-hour pad test were randomly assigned into IC and BF groups, according to the application order. The patient flow diagram is presented in figure 1.

Age, height, weight and body mass index values were recorded as physical characteristics. Number of pregnancies, parity, abortions, dilatation & curettage (D&C), type of delivery and presence of episiotomy and/or perineal tears were recorded as obstetrical history. Duration of the incontinence problem and menstrual status of the subjects were determined. In addition, duration of

Figure 1
Patient flow diagram.



menopause for those subjects in the postmenopausal period was recorded.

Smoking habit and alcohol consumption, presence of constipation, chronic coughing, allergy, heart disease, blood pressure problems and diuretic drug usage were recorded because of their possible effects on urinary incontinence.

A one-hour pad test was performed to determine the incontinence intensity [3]. A sensitive balance (Sartorius, BP 310 S) was used to measure the weight of the pad before and after the test and the difference was recorded as the amount of urine leakage.

Pelvic floor muscle strength was measured with BF device (Myomed 932 Enraf Nonius) in lithotomy position, using a vaginal probe. For each case, measurements were performed three times and the mean value was noted as the pelvic floor muscle strength. Before the test, subjects were asked not to hold their breath, or contract their abdominal, gluteal or thigh muscles during the evaluation, in order to obtain an accurate value of pelvic floor muscle strength. The same physiotherapist performed pre-treatment and post-treatment measurements, by controlling the interference of the above mentioned muscles.

A 28 itemed questionnaire graded from 0 to 3 for each item (0 = best score, 84 = worst score) was completed by the subjects in order to determine the effects of the incontinence problem on the quality of life [15].

In 20 patients IC with a frequency of 0–100 Hz was applied for a duration of 15 minutes, three times a week for a total of 15 sessions. Two vacuum electrodes were placed in the suprapubic region, whilst another two were positioned near to the medial side of the ischial tuberosity, crosswise.

The second group included 20 subjects, who performed Kegel exercises using a BF device during 15 minutes, three times a week, for a total of 15 sessions. The treatment protocol was individually designed and all of the patients were instructed in the use of a BF device to obtain isolated pelvic floor muscle contraction. Before starting the treatment, duration of maintenance of maximum contraction of the pelvic floor muscles was determined for each patient. This duration was then taken as the working period in the initial treatment sessions, and increased as the capability to maintain the maximal contraction improved. A ten second resting period was given between the working periods.

All of the cases were re-evaluated after the treatment program had been carried out on every other day for five weeks. Patients were also observed for possible adverse effects of the methods such as allergic skin reactions, erythema, inflammation and pain. At discharge, cases in both groups were advised to continue with a home program including Kegel exercises in order to maintain the effects of the treatments.

Statistics

Statistical analysis was accomplished on a personal computer by using statistical package for social sciences version 12.0 (SPSS 12.0, demo, SPSS Inc. Chicago, Illinois). Quantitative and qualitative data were presented as convention mean (standard deviation) and n (%), respectively. Intra-group differences of the pad test, pelvic floor muscle strength values and QoLQ scores were analysed by t-test for paired samples. Pre and post treatment differences of means in pad test, pelvic floor muscle strength and quality of life questionnaire values between groups were analysed by t-test for independent samples. 95% confidence intervals (95% CI) were used for statistical significance.

Results

The mean age of the cases was 50.4 (SD = 6.9) years. Physical properties of the subjects in each group are presented in table 1. The mean duration of incontinence complaint was 6.5 (SD = 6.2) years in IC Group and 5.8 (SD = 7.1) years in BF Group.

Table 1

Physical characteristics and possible risk factors related to urinary incontinence of the subjects.

	IC	BF
Physical characteristics	**Mean (SD)**	**Mean (SD)**
Age (years)	52 (7)	49 (7)
Height (cm)	160 (5)	160 (5)
Weight (kg)	72 (11)	67 (11)
Body mass index (kg/m^2)	28 (4)	26 (5)
Obstetrical history	**Mean (SD)**	**Mean (SD)**
Pregnancies	5(4)	5(3)
Parity	3(3)	3(2)
Abortions	1(1)	1(1)
Dilatation and curettage	1(1)	1(1)
Possible risk factors	**n (%)**	**n (%)**
Smoking	9 (53)	8 (47)
Chronic coughing	3 (50)	3 (50)
Allergic conditions	4 (40)	6 (60)
Heart disease	4 (57)	3 (43)
Problems about blood pressure	5 (71)	2 (29)
Constipation	3 (43)	4 (57)
Diuretic drug use	4 (57)	3 (43)

Twelve cases (60%) in BF group and six cases (30%) in IC group were in the postmenopausal period. The mean duration of menopause was 4.8 (SD = 5) years in IC Group and 3.6 (SD = 5) years in BF Group.

There were no apparent differences between the groups for pregnancies, parity, number of abortions and Dilatation and Curettages (table 1).

All but one patient in each group indicated that they had delivered vaginally. Mean number of vaginal labour was 3 (SD = 2) (minimum = 0, maximum = 9) in IC group and 3 (SD = 2) (minimum = 0, maximum = 8) in BF group. One case in IC group and two in the other group had experience of caesarean section.

Eight (40%) cases in IC group and seven (35%) in BF group indicated that they had experienced a perineal tear during labour. Episiotomy was recorded in 12 (60%) cases in IC group and in 10 (50%) cases in the other group.

Factors that may have a possible effect on urinary incontinence such as smoking, chronic coughing, allergic conditions, heart disease, problems with blood pressure, constipation or diuretic drug use are presented in table 1.

Figure 2

Pre and post treatment mean (95% CI) values of the groups.

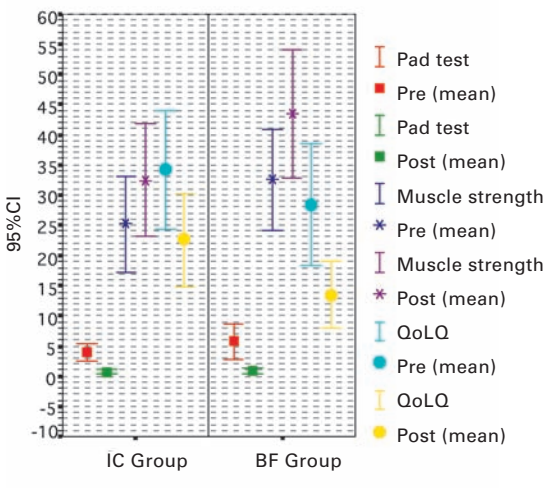


Figure 3

Change of the values over time in each group.

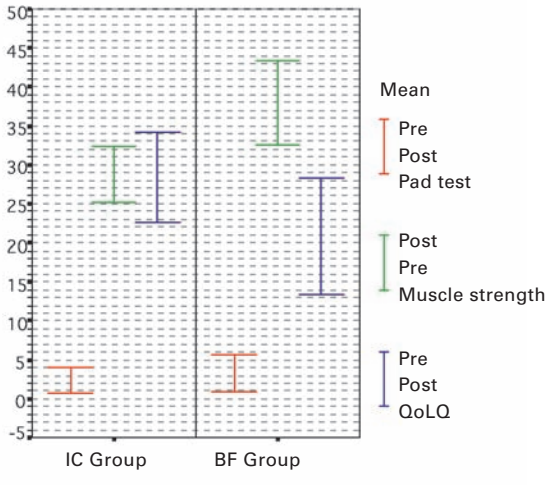


Figure 2 presents pre and post treatment means (95% CI) of the IC and BF groups. Incontinence intensity (95% CI: 1.9 – 4.53 and 1.94 – 7.65 for IC and BF groups, respectively) pelvic floor muscle strength (95% CI: -10.05 – -4.41 and -15.96 – -6.01 for IC and BF groups, respectively) and quality of life questionnaire scores (95% CI: 6.75 – 16.46 and 7.44 – 22.36 for IC and BF groups, respectively) significantly improved at the end of treatment programs (figure 3).

The degree of improvement in the intensity of incontinence (95% CI: -1.48 – 4.59), pelvic muscle strength (95% CI: -9.29 – 1.78) and quality of life (95% CI: -11.91 – 5.31) was found to be similar in both groups (table 2).

No adverse effects were observed during treatments.

Discussion

The findings of this study reveal that both IC and BF procedures are of benefit in patients with USI, in regard to improvement in intensity of incontinence, pelvic muscle strength and quality of life. In addition, the degree of improvement experienced using these methods seems to be similar.

In the literature, studies on the conservative treatment of USI include methods such as pelvic floor exercises, electrical stimulation, vaginal cones, bladder training and biofeedback [12, 16–20]. BF can be applied alone or can be combined with other procedures in USI treatment [19, 21–23].

Pages et al, compared the effects of pelvic floor exercises and BF in 40 women with USI and found that voiding frequency and the subjective complaints of the cases improved in both groups after four weeks of treatment followed by two weeks with a home program. They indicated that the improvement in voiding frequency was more evident in cases that performed pelvic floor exercises whereas the increase in the pelvic floor muscle strength and reduction of subjective complaints were more evident in BF group [19].

Berghmans et al. investigated the effects of pelvic floor exercises with and without BF application in 44 patients of USI. They have pointed out that the combined approach was more effective than performing pelvic floor exercise alone [22].

In this study, BF was found effective in improving the pelvic floor muscle strength, pad test amount and quality of life questionnaire results.

There are a limited number of studies on the use of IC in USI treatment. Dumoulin et al. investigated the effects of combined IC and exercise on pelvic floor muscle strength and incontinence intensity in eight cases with a postpartum USI prob-

Table 2

Comparison of pre and post treatment differences in pad test, pelvic floor muscle strength and quality of life questionnaire values between groups (t-test for independent samples).

	IC	BF	95% Confidence interval of the difference of means	
	Mean (SD)	Mean (SD)	Lower	Upper
Pad test (g)	–3.2 (2.8)	–4.8 (6.1)	–1.48	4.59
Muscle strength (hPa)	7.2 (6)	11(10.6)	–9.29	1.78
QoLQ score	–11.6 (10.4)	–14.9 (15.9)	–11.91	5.31

QoLQ: Quality of Life Questionnaire

lem. They found that all of the parameters improved after three weeks of treatment [12].

Another example of the literature on IC in patients with USI is the study of Turkan et al. They presented the results of a physical therapy program consisting of the use of IC and Kegel exercises in patients with different intensities of urodynamic incontinence, but not in comparison with other treatment modalities. They indicated that the program was more effective in cases with mild and moderate incontinence intensity rather than in those with severe incontinence [4].

Parallel to the results of the related literature, BF and IC have been found effective in improving pelvic floor muscle strength, incontinence intensity and QOL of cases in this study. These methods can be used in clinical practice as they are non invasive, easily applied and well tolerated. Interferential current may be preferred when biofeedback application is not appropriate, as in some geriatric patients (in whom cooperation is reduced due to visual or auditory incapacity), in children or in patients who are not willing to use intravaginal/rectal applications. Although statistical analyses revealed that IC and BF seemed to cause similar amount of improvement in the measured variables, results of studies including a greater number of subjects are needed to ascertain any clinically useful differences between the two methods.

As the follow-up period of all cases is not completed, it is planned to present the long term results of these treatments in a further study. Subjects who successfully perform a home program will be compared with those who fail to sustain the exercise program.

The points that can be investigated in further studies include the results of IC and BF in different intensities of USI, comparison with the results with other physiotherapeutic approaches and the effects of different frequencies of IC in USI patients.

Correspondence:
Türkan Akbayrak, PT, PhD
Assoc Prof, Hacettepe University
Faculty of Health Science
Department of Physical Therapy
and Rehabilitation
Women's Health Unit, 06100
Samanpazarı, Ankara, Turkey
E-Mail: takbayrak@yahoo.com

References

1 Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, Kerrebroeck P, Victor A, Wein A. The standardisation of terminology of lower urinary tract function:report from the standardisation sub-committee of the international continence society. Neurology and Urodynamics. 2002;21:167–78.
2 Herman H. Urogenital Dysfunction. In: Wilder E (ed). Obstetric and Gynecologic Physical Therapy, Churchill Livingstone, New York, 1988, pp: 83–111.
3 Polden M, Mantle J. Continence and incontinence. In: Polden M, Mantle J (eds). Physiotherapy in Obstetrics and Gynaecology, Butterworth-Heinemann, Oxford, 1994, pp: 335–87.
4 Turkan A, Inci Y, Fazli D. The short-term effects of physical therapy in different intensities of urodynamic stress incontinence. Gynecol Obstet Invest. 2005;59:43–8.
5 Ostergard DR, Bent AE (eds). Urogynecology and Urodynamics: Theory and Practice, Williams and Wilkins, Baltimore, 1991, pp: 3–228.
6 Malone-Lee J. Recent developments in urinary incontinence in late life. Physiotherapy. 1994;80:133–4.
7 McGuire EJ. Identifying and managing stress incontinence in the elderly. Geriatrics. 1990;35:44–52.
8 Aksac B, Aki S, Karan A, Yalcin O, Isikoglu M, Eskiyurt N. Biofeedback and pelvic floor exercises for the rehabilitation of urinary stress incontinence. Gynecol Obstet Invest. 2003;56: 23–7.
9 Knight S, Laycock J. The role of biofeedback in pelvic floor re-education. Physiotherapy. 1994;86:145–8.
10 Alexander S, Rowan D. Electrical control of urinary incontinence: a clinical appraisal. Br J Surg. 1970;57:766–8.
11 Blowman C. Prospective double blind controlled trial of intensive physiotherapy with and without stimulation of the pelvic floor in treatment of genuine stress incontinence. Physiotherapy. 1991;77:661–4.
12 Dumoulin C, Seaborne DE, Quirion-DeGirardi C, Sullivan SJ. Pelvic-floor rehabilitation, part 2: pelvic-floor re-education with interferential currents and exercise in the treatment of genuine stress incontinence in postpartum women: a cohort study. Physiotherapy. 1995;75:1075–81.
13 Laycock J, Green RJ. Interferential therapy in the treatment of incontinence. Physiotherapy. 1988;74:161–8.
14 Low J, Reed A, Dyson M (eds). Interferential Currents. Electrotherapy Explained (Principles and Practice), Butterworth-Heinemann, Oxford, 1990; pp: 36–7.
15 Karan A, Aksaç B, Ayyıldız H, Işıkoğlu M, Yalçın Ö, Eskiyurt N. Quality of life and its relation with objective assessment parameters in urinary incontinent patients. Turk J Geriatrics. 2000; 3:102–6.
16 Mantle J, Vesi E. Physiotherapy for stress urinary incontinence: a national survey. BMJ. 1991;30:753–5.
17 Moore KH. Conservative management for urinary incontinence. Baillieres Best Pract Res Clin Obstet Gynaecol. 2000; 14:251–89.
18 Olah KS, Bridges N, Denning J, Farrar DJ. The conservative management of patients with symptoms of stress incontinence: a randomized, prospective study comparing weighted vaginal cones and interferential therapy. Am J Obstet Gynecol. 1990; 162:87–92.
19 Pages IH, Jahr S, Schaufele MK, Conradi E. Comparative analysis of biofeedback and physical therapy for treatment of urinary stress incontinence in women. Am J Phys Med Rehabil. 2001;80:494–502.
20 Smith AL, Moy ML. Modern management of women with stress urinary incontinence. Ostomy Wound Manage. 2004;50: 32–9.
21 Aukee P, Immonen P, Laaksonen DE, Laippala P, Penttinen J, Airaksinen O. The effect of home biofeedback training on stress incontinence. Acta Obstet Gynecol Scand. 2004;83:973–7.
22 Berghmans LC, Frederiks CM, de Bie RA, Weil EH, Smeets LW, van Waalwijk van Doorn ES, Janknegt RA. Efficacy of biofeedback, when included with pelvic floor muscle exercise treatment, for genuine stress incontinence. Neurourol Urodyn. 1996;15:37–52.
23 Seo JT, Yoon H, Kim YH. A randomized prospective study comparing new vaginal cone and FES-Biofeedback. Yonsei Med J. 2004;45:879–84.

Established in 1871

Formerly: Schweizerische Medizinische Wochenschrift

SMW Swiss Medical Weekly

The European Journal of Medical Sciences

The many reasons why you should choose SMW to publish your research

What Swiss Medical Weekly has to offer:

- SMW's impact factor has been steadily rising. The 2006 impact factor is 1.346.
- Open access to the publication via the Internet, therefore wide audience and impact
- Rapid listing in Medline
- LinkOut-button from PubMed with link to the full text website http://www.smw.ch (direct link from each SMW record in PubMed)

- No-nonsense submission – you submit a single copy of your manuscript by e-mail attachment
- Peer review based on a broad spectrum of international academic referees
- Assistance of professional statisticians for every article with statistical analyses

- Fast peer review, by e-mail exchange with the referees
- Prompt decisions based on weekly conferences of the Editorial Board
- Prompt notification on the status of your manuscript by e-mail
- Professional English copy editing

We evaluate manuscripts of broad clinical interest from all specialities, including experimental medicine and clinical investigation.

We look forward to receiving your paper!

Guidelines for authors:
http://www.smw.ch/set_authors.html

All manuscripts should be sent in electronic form, to:

EMH Swiss Medical Publishers Ltd.
SMW Editorial Secretariat
Farnsburgerstrasse 8
CH-4132 Muttenz

Manuscripts:	submission@smw.ch
Letters to the editor:	letters@smw.ch
Editorial Board:	red@smw.ch
Internet:	http://www.smw.ch

EMH FMH Schwabe
Editores Medicorum Helveticorum

Official journal of the Swiss Society of Infectious Diseases, the Swiss Society of Internal Medicine and the Swiss Respiratory Society

Supported by the FMH (Swiss Medical Association) and by Schwabe AG, the long-established scientific publishing house founded in 1488