($P = 0.009$) (Fig. 2). We did not find a correlation between pain threshold and anxiety or stress indices.

Our study results suggest that single measurements of pain threshold may not be fully representative of a person's pain sensitivity, in particular when trying to correlate it with hormonal changes. There are a multitude of factors involved in an individual's sensitivity and response to a painful stimulus and hormonal influences may play a minor role. The impact of day to day stresses on a person's pain threshold also appears to be of low significance.

This unpredictable variation in pain threshold within a single cycle and between cycles has important implications for study purposes and may be a reason for the lack of reproduction of studies published.

References

Giamberardino MA, Berkley KJ, Lezzi S, de Bigontina P, Vecchiet L. Pain threshold variations in somatic wall tissues as a function of menstrual cycle, segmental site and tissue depth in non-dysmenorrheic women, dysmenorrheic women and men. Pain 1997;71:187–197.

Hapidou FG, Rollman GB. Menstrual cycle modulation of tender points. Pain 1998;77:151–161.

Wolfe F, Smythe HA, Yunus MB, Bennett RM, Bombardier C, et al. The American College of Rheumatology (1990): criteria for the classification of fibromyalgia. Arthritis Rheum 1990;33:160–172.

Wolfe F. Data collection and utilization: A methodology for clinical practice and clinical research. In: Wolfe F, Pincus T, editors. Rheumatoid arthritis: pathogenesis, assessment outcome and treatment, New York: Marcel Dekker, 1994. pp. 463–514.

Kanner AD, Coyne JC, Schaefer C, et al. Comparison of two modes of stress measurement: daily hassles and uplifts versus major life events. J Behav Med 1981;4:1–39.

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Reproductive hormones and the modulation of muscle pain, reply to Johns and Littlejohn

Johns and Littlejohn's letter helps to complement our (Hapidou and Rollman, 1998) paper on menstrual cycle modulation of muscle-related pain. First, it demonstrates the considerable inter- and intraindividual differences that often arise in pain assessment. Second, it replicates our report of no effects of menstrual phase on dolorimetry threshold or total myalgic score.

In doing so, their study highlights some of the issues which arise in examinations of hormonal modulation of pain since they, like we, are struck by the apparent contradictions which exist in the literature. As we noted in our paper, numerous researchers have shown phase-related fluctuations in pain responsiveness, sometimes claiming that pain sensitivity is highest in the luteal (postovulatory) phase and lowest in the follicular (preovulatory) phase and sometimes, paradoxically, finding the reverse. Others, have found no menstrual cycle effects at all.

Our study was noteworthy because it demonstrated, in the same population of subjects, that one could find both a significant cycle-related effect (the number of tender points, identified by palpation, was greatest in the follicular and least in the luteal phase in normally cycling young women) and the absence of any effect (the average pain threshold, determined by dolorimetry, was lower at tender points than control points but was unaltered by menstrual phase). We discussed a number of possible reasons for this critical difference but one, in particular, stood out. The data reported by Johns and Littlejohn (1999) reinforce our view.

Dolorimetry scores are based upon all subjects undergoing evaluation. If you press at a site hard enough you can get the subject to say that it hurts. Tender points, however, are not present in all subjects. In our study, for example, more than 20% of the subjects had no tender points. Consequently, our evaluation of menstrual phase on tender point was based only upon those who showed some element of muscle sensitivity to relatively gentle pressure (1 kg).

Johns and Littlejohn average their data across 22 sites but one can see from their Fig. 1 that the average dolorimetry threshold varies across subjects from about 4–8 kg. There is a hint in their data that those with thresholds below 5 kg will, on average, have their lowest threshold at week 2 (the follicular phase) where we found that tender point sensitivity was at its greatest. If so, this mirrors our data, since our subjects showed a significant negative correlation between number of tender points and dolorimetry threshold.

While there are some remarkable interindividual differences in Fig. 1 of Johns and Littlejohn's letter, evaluation of possible cyclical effects requires analyses for a larger sample of normally menstruating women. It would be helpful to learn whether there is intraindividual consistency across successive cycles, a question that can be answered by performing a hierarchical cluster analysis (SPSS, 1997). Similar analyses have been performed to empirically cluster MMPI profiles into prototypes, based upon the concept that there are a relatively small number of different profiles (high on some scales, low on others, intermediate on yet others). Costello et al. (1987) have summarized a series of studies which used empirical clustering algorithms for MMPI profiles of pain patients, finding that four patterns emerged.

It is not, however, only the phase differences that stand out in Johns and Littlejohn's Fig. 1. The length of the menstrual cycle for the women who were tested also varies widely. Some women appear to have a 3-week cycle while for others it is as much as 6 weeks long. We were careful to include only those subjects whose cycles were regular and 28 to 31 days in length. At best, only 4 of Johns and Littlejohn's 9 women meet that criterion (and this small sample makes is unlikely that significant phase effects on dolorimetry scores, even if present, would be detected). It is interesting to observe that those with 5 and 6 week cycles were also those whose threshold was most inconsistent with the pattern seen for the more regularly cycling subjects, showing either wild swings or no changes at all.

Taken together, their study and ours show that women with low

dolorimetry thresholds tend to have more tender points and that tenderness of these points varies with menstrual phase. Fig. 2 of Johns and Littlejohn's letter does not include a correlation coefficient but indicates that subjects with higher levels of depression, as measured by the Depression Scale portion of the Arthritis Impact Measurement Scales, tend to show a lower Total Myalgic Score (and, therefore, have lower dolorimetry thresholds). The clustering of low pain thresholds, multiple tender points whose incidence is modulated by menstrual phase, and higher depression scores may predispose a subset of women to developing fibromyalgia and other myofascial pain disorders. A large prospective study, extending over many years, is needed in order to properly evaluate this hypothesis.

The effect of menstrual phase on pain threshold, when found, is often relatively small (Rollman and Lautenbacher, 1993). We found considerably larger differences for the effects of phase on the number of tender points. As we noted in our paper, the effects of reproductive hormones on clinically-relevant pain have not been widely studied and deserve careful attention. Dao et al. (1998) had female patients track morning and evening levels of facial pain in daily diaries over three successive menstrual cycles. Oral contraceptive users, whose hormonal levels were controlled, showed markedly less variance in morning pain levels than the non-users. LeResche et al. (1997) found an increased risk of temporomandibular disorders (TMD) among post-menopausal women who received estrogen replacement therapy compared to those not exposed and increased risk for TMD among younger women who used oral contraceptives. Marbach et al. (1995) added another variable of importance in the examination of fluctuations in facial pain. They showed that TMD patients, studied monthly over ten months, had seasonal variations, exhibiting notably higher levels of pain in the dark months. There is some evidence (Moldofsky, 1994) of similar variation among fibromyalgia patients.

References

Costello RM, Hulsey TL, Schoenfeld LS, Ramamurthy S. P-A-I-N: a four-cluster MMPI typology for chronic pain. Pain 1987;30:199–209.

Dao TTT, Knight K, Ton-That V. Modulation of myofascial pain by the reproductive hormones: a preliminary report. J Prosthet Dent 1998;79:663–670.

Hapidou EG, Rollman GB. Menstrual cycle modulation of tender points. Pain 1998;77:151–161.

Johns KR, Littlejohn GO. The role of sex hormones in pain response, Pain 1999;83:112–113.

LeResche L, Saunders K, Von Korff MR, Barlow W, Dworkin SF. Use of exogenous hormones and risk of temporomandibular disorder pain. Pain 1997;69:153–160.

Marbach JJ, Raphael KG, Dohrenwend BP. Do premenstrual pain and edema exhibit seasonal variability? Psychosom Med 1995;57:536–541.

Moldofsky H. Chronobiological influences on fibromyalgia syndrome: Theoretical and therapeutic implications. Baillieres Clin Rheumatol 1994;8:801–810.

Rollman GB, Lautenbacher S. Sex differences and biological rhythms affecting pain responsiveness. Pain 1993;55:277.

SPSS Base 7.5 for Windows User's Guide, SPSS Inc. Chicago, 1997.

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