Spine

BIOMECHANICS

Male Spine Motion During Coitus

Implications for the Low Back Pain Patient

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Study Design. Repeated measures design.

Objective. To describe male spine movement and posture characteristics during coitus and compare these characteristics across 5 common coital positions.

Summary of Background Data. Exacerbation of pain during coitus due to coital movements and positions is a prevalent issue reported by low back pain patients. A biomechanical analysis of spine movements and postures during coitus has never been conducted.

Methods. Ten healthy males and females engaged in coitus in the following preselected positions and variations: QUADRUPED, MISSIONARY, and SIDELYING. An optoelectronic motion capture system was used to measure 3-dimensional lumbar spine angles that were normalized to upright standing. To determine whether each coital position had distinct spine kinematic profiles, separate univariate general linear models, followed by Tukey's honestly significant difference *post hoc* analysis were used. The presentation of coital positions was randomized.

Results. Both variations of QUADRUPED, mQUAD1 and mQUAD2, were found to have a significantly higher cycle speed than mSIDE ($P = 0.043$ and $P = 0.034$, respectively), mMISS1 ($P = 0.003$ and $P = 0.002$, respectively), and mMISS2 ($P = 0.001$ and $P < 0.001$, respectively). Male lumbar spine movement varied depending on the coital position; however, across all positions, the majority of the range of motion used was in flexion. Based on range of motion, the least-to-most recommended positions for a male flexion-intolerant patient are mSIDE, mMISS2, mQUAD2, mMISS1, and mQUAD1.

Conclusion. Initial recommendations—which include specific coital positions to avoid, movement strategies, and role of the partner—were developed for male patients whose low back pain is exacerbated by specific motions and postures.

Key words: lumbar spine, biomechanics, coitus, low back pain, sexual intercourse, quality of life, coital position.

Level of Evidence: N/A

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S everal qualitative studies investigating the sexual activity of people with low back pain (LBP) and/or injury have consistently reported that this population experiences a marked reduction in coital frequency. Approximately 34%[1] to 84%[2] of males with LBP have reported a decrease in the frequency of coitus. Sexual activity is a known indicator of quality of life[3] and is recognized as an integral measure of health and disability; the Oswestry Disability Index Version 1.0[4] includes "sex life" in its measure of disability, and the World Health Organization's International Classification of Functioning, Disability and Health[5] regards sexual relationships as an integral factor in the international standard to describe and measure health and disability.

The reported factors that are attributed to this reduced frequency are not only psychological (*e.g.*, fear avoidance) but also mechanical. One study found that "sex life" was reported as causing additional pain in 84% of patients with chronic LBP and that sex life had improved 2 years postoperatively—this improvement was correlated strongest with a decrease in back pain (measured by visual analogue scale).[6] In another sample of patients with chronic LBP, 64% (of a sample that was 89% male) reported worsening of pain due to sexual intercourse.[7]

In a questionnaire-based study,[1] 22% of males with LBP reported marked discomfort during intercourse—among these males, two of the most commonly reported sources of this discomfort were difficulty finding a position and with pelvic movements. Structured interviews of males and females with chronic LBP yielded similar results: after the onset of disabling LBP, the type of positions used were changed.[8] These patients also disclosed that one of the important factors restricting sexual enjoyment was the LBP itself.[8] It seems that a large percentage of males with LBP attempt to maintain their typical coital frequency but are limited by an exacerbation of pain because of the movements and postures of coitus.

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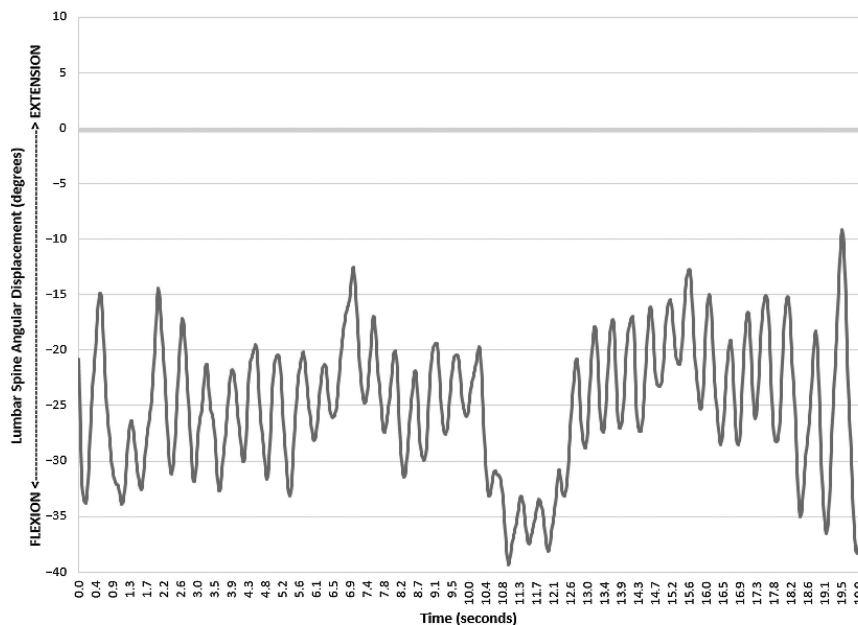
Figure 1. Sample data from 1 subject for mSIDE, which demonstrates the variability in spine motion during a trial. Table 3 reports both the absolute maxima and minima scores for each trial, which occur at approximately 19.5 and 11 seconds in this trial, respectively, as well as an average of the local maxima and minima found throughout a 20-second trial.

Despite compelling qualitative evidence that pain during coitus results in coital frequency reduction and the recognized effect that sexual activity has on quality of life, health, and disability, a biomechanical analysis of movements and postures during basic coital positions has never been conducted. The objectives of this study were to first describe male spine movement and posture characteristics during coitus and compare these characteristics across 5 common coital positions. It was expected that lumbar spine movement would primarily occur in the sagittal plane of motion and that each coital position would have a distinct spine kinematic profile.

MATERIALS AND METHODS

All subject recruitment and data collection procedures were performed in accordance with the university's office of research ethics guidelines.

Participants

Ten healthy males (29.3 ± 6.9 yr, 176.5 ± 8.6 cm, 84.9 ± 14.5 kg) and 10 healthy females—with 4.7 ± 3.9 years of sexual experience with each other—were recruited for analysis in this study. Participants were excluded from this study if they had a history of spinal, abdominal, or hip surgery; a pre-existing disabling back or hip condition; current and relevant musculoskeletal concerns; any sexual dysfunction that would prevent them from engaging in coitus for the duration of the data collection; and registered student status at the university.

Coital Positions

Given the descriptive nature of this study, participants were given very little coaching; they were cued to "move as naturally as possible," which was intentionally vague. Five coital positions were randomized by assigning a number to each position, using a random number generating function to determine the order of presentation, and placing an illustration of

each position, in its randomized order, on the laboratory wall within sight of the couple. The couple was able to refer to the illustrations on the laboratory wall during the data collection to ensure that they were performing each position in the assigned order.

The electromagnetic motion capture system used to track the motion of the female participant's spine was limited to 32 seconds of data collection; because this system was synchronized with the motion capture system being used to track male spine motion, a trial duration of 20 seconds was used. Given this limited data collection time, and to avoid as much variation in speed and intensity as possible during each trial, participants signaled the researcher when they had reached what they considered to be their "natural coital speed and/or rhythm"—data collection for each trial began at this point.

Previous literature has identified common coital positions for those with LBP[1,7,8]—these positions, as well as commonly recommended positions for patients with LBP,[9] and a biomechanical rationale influenced the inclusion of the following 5 coital positions in this study:

QUADRUPED

Rear-entry, in which the female is in the quadruped position and the male is kneeling behind her. Two variations of QUADRUPED were included in this study: one in which the female is supporting her upper body with her elbows (mQUAD1) and the other with her hands (mQUAD2).

MISSIONARY

Front-entry, in which the female is lying supine and the male is in the prone position on top of her. Two variations of MISSIONARY were included in this study: one which the male is supporting his upper body with his hands and the female is minimally flexed at the hips and knees (mMISS1) and the other in which the male is supporting his upper body with

his elbows and the female is flexed at the hips and knees (mMISS2).

SIDELYING

Rear-entry, in which the female is lying on her left side and the male is lying on his left side behind her with their hips and knees flexed (mSIDE).

Maximum Active Range of Motion

After completion of all coitus trials, each participant was asked to assume an upright standing posture (*i.e.*, neutral) and bend forward, extend back, side-bend (to the left and right), and twist (to the left and right) at the waist as far as he or she could. This trial was considered the active range of motion (aROM) trial, in which it was assumed that maximum range of lumbar spine flexion, extension, lateral flexion, and axial rotation of the lumbar spine were achieved through active movement without any assistance.

Data Collection

To quantitatively measure the 3-dimensional (3D) lumbar spine kinematics, the torso and the pelvis were monitored using 8 optoelectronic motion capture cameras (Vicon MX20+, Vicon Motion Systems, Oxford, United Kingdom). These cameras monitored the location of 6 individual spherical reflective markers (Vicon MX, 12.5 mm in diameter, Vicon Motion Systems, Oxford, United Kingdom), adhered to the skin overlying the right and left acromion, iliac crests, and greater trochanters (these were removed after calibration), and 2 rigid marker clusters, 1 over the spinous process of the 12th thoracic vertebra and 1 over the sacrum, each instrumented with 5 noncollinear individual spherical reflective markers. All individual markers and rigid marker clusters were affixed to the participant's skin with adhesive tape. Three-dimensional lumbar spine kinematic signals were continuously collected

for the duration of each trial and were sampled at a rate of 60 Hz. These data were collected using Vicon Nexus 1.7 software (Vicon Motion Systems, Oxford, United Kingdom) and securely stored on a password-protected personal computer.

Data Processing

Data processing was performed using Visual3D software (Version 4.96.11; C-Motion Inc., Rockville, MD). Raw kinematic data were filtered using a second-order, low-pass digital Butterworth filter with a cutoff frequency of 6 Hz.

The 3D coordinates of the calibration markers and rigid marker clusters were then used to construct a link-segment model of the torso and the pelvis. The relative orientation of the pelvis with respect to the torso was then computed to determine the 3D lumbar spine angles.

Using a custom computer program in MATLAB software (Version r2009B; The MathWorks Inc., Natick, MA), these spine angles were normalized to the maximum amplitude achieved during the maximum aROM trial and expressed as a percentage of these maximums (*e.g.*, 50% of maximum flexion aROM). Speed of penetration was also calculated; a kinematic threshold—maximum hip flexion of the male participant—was used to determine the start of a penetration cycle.

An amplitude probability distribution function was then calculated for each position. This provided insight into the distribution of the varying spine angles (expressed as a percentage of full aROM) achieved during each trial (see Figure 1 for an example of variable spine motion during a given position). Specifically, the amplitude probability at a certain spine angle value is the probability that the spine angle is equal to that value or less than that.[10] Thus, the amplitude probability distribution function determines the range of spine angles achieved (*i.e.*, maximum, minimum, and median spine angles are values found at amplitude probabilities of 1.0, 0.0, and 0.5, respectively).

Figure 2. Amplitude probability distribution of average lumbar spine angular displacement (% aROM) across all coital positions. The dashed horizontal lines indicate the amplitude probabilities at which statistical tests were performed (*i.e.*, 0.0, 0.5, and 1.0). The dashed vertical line indicates zero lumbar spine angular displacement (*i.e.*, a neutral spine position in upright standing)—to the left of this line is lumbar spine flexion and to the right of this line is lumbar spine extension. The angular displacement values at any amplitude probability can be interpreted as the probability that angular displacement was equal to or lower than that value during that coital position. Using mMISS2 as an example, 50% of the time during mMISS2, spine motion was equal to or less than approximately 32% of lumbar spine flexion aROM. aROM indicates active range of motion.
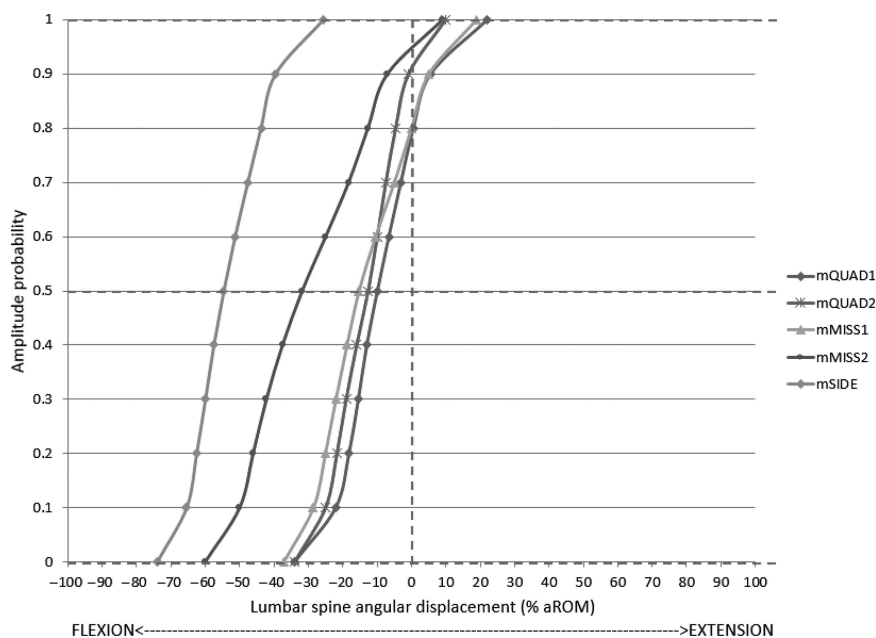
TABLE 1. Penetration Cycle Speed (Cycles/Second) by Coital Position

Coital Position	Penetration Cycle Speed
mQUAD1	1.80 ± 0.72
mQUAD2	1.81 ± 0.72
mMISS1	1.37 ± 0.68
mMISS2	1.33 ± 0.49
mSIDE	1.50 ± 0.60

Data Analysis

IBM SPSS Statistics software (Version 19, IBM Corporation, Somers, NY) was used for all statistical analysis. In this study, the independent variable was coital position and the dependent variables were the 3D lumbar spine angular displacements (expressed as a percentage of lumbar spine aROM) at amplitude probabilities of 0.0, 0.5, and 1.0, and penetration speed.

Separate univariate general linear models (factor: coital position = 5 levels, α = 0.05) were used at all 3 of these amplitude probabilities to assess whether each coital position had distinct spine kinematic profiles. This was followed by Tukey's honestly significant difference *post hoc* analysis to assess any main effects of coital position on spine kinematics.

RESULTS

Upon visual inspection of the kinematic data across all coital positions, it was found that the majority of the kinematic signal was in the sagittal plane (*i.e.*, flexion/extension). For this reason, only findings pertaining to the sagittal plane of motion are discussed later. The sign convention for flexion and extension is negative and positive, respectively.

With respect to average rate of penetration cycles (see Table 1 for mean values), both variations of QUADRUPED, mQUAD1 and mQUAD2, were found to be significantly higher ($F_{4,35}$ = 9.271, $P < 0.001$) than mSIDE ($P = 0.043$ and $P = 0.034$, respectively) and both variations of MISSIONARY, mMISS1 ($P = 0.003$ and $P = 0.002$, respectively) and mMISS2 ($P = 0.001$ and $P < 0.001$, respectively).

Lumbar spine movement range varied depending on the coital position; however, across all positions, the majority of the range was in flexion. The mean values for each coital position at several amplitude probabilities, including 0.0, 0.5, and 1.0, are shown in Table 2 and Figure 2. The raw scores are also provided in Table 3 for the interested reader; the absolute maximum and minimum of each trial as well as an average of all local maxima and minima values are included because of the variability of spine motion during a trial (Figure 1).

Amplitude probability distribution function values were compared at probabilities of 0.0, 0.5, and 1.0. Significant differences were found at probabilities of 0.0 ($F_{4,35}$ = 17.717, $P < 0.001$), 0.5 ($F_{4,35}$ = 12.892, $P < 0.001$), and 1.0 ($F_{4,35}$ = 4.110, $P = 0.008$) (see Figure 3). At an amplitude probability of 0.0, which can be considered the lowest spine angle value achieved in each coital position, mSIDE was significantly lower than mQUAD1 ($P < 0.001$), mQUAD2 ($P < 0.001$), and mMISS1 ($P < 0.001$). mMISS2 was also significantly lower than mQUAD1 ($P = 0.001$), mQUAD2 ($P = 0.001$), and mMISS1 ($P = 0.008$) at an amplitude probability of 0.0. At an amplitude probability of 0.5, which can be considered the median spine angle value achieved in each coital position, mSIDE was significantly lower than mQUAD1 ($P < 0.001$), mQUAD2 ($P < 0.001$), mMISS1 ($P < 0.001$), and mMISS2 ($P = 0.030$). mMISS2 was also significantly lower than mQUAD1 ($P = 0.001$) at an amplitude probability of 0.5. At an amplitude probability of 1.0, which can be considered the highest spine angle value achieved in each coital position, mSIDE was significantly lower than mQUAD1 ($P = 0.008$) and mMISS1 ($P = 0.020$).

DISCUSSION

To our knowledge, a biomechanical analysis of coitus has never been conducted; the successful collection of kinematic data during this study demonstrates that such an analysis is feasible. The main objectives of this study were to describe male spine kinematics during coitus and compare movement and posture characteristics across 5 common coital positions.

This study documented spine mechanics in a sample that did not have a preexisting, disabling back or hip condition. As a result, the possible demands and risk factors of several coital positions for exacerbating specific subgroups of LBP were revealed. Despite a well-established biomechanical logic

TABLE 2. Lumbar Spine Angular Displacement (% Active Range of Motion) by Coital Position for Specific Amplitude Probabilities*

Amplitude Probability	mQUAD1	mQUAD2	mMISS1	mMISS2	mSIDE
0.0	−34.0 ± 20.52	−34.00 ± 16.63	−37.22 ± 21.95	−60.00 ± 10.15	−74.00 ± 15.96
0.1	−22.01 ± 21.61	−24.95 ± 15.60	−28.58 ± 22.33	−49.97 ± 19.91	−65.40 ± 15.37
0.5	−9.90 ± 26.16	−12.54 ± 21.02	−15.29 ± 25.18	−31.79 ± 21.07	−54.55 ± 16.55
0.9	5.55 ± 35.84	−0.78 ± 27.15	5.07 ± 38.75	−7.02 ± 25.04	−39.43 ± 19.30
1.0	22.00 ± 44.11	10 ± 30.09	18.89 ± 45.61	9.00 ± 27.97	−25.5 ± 20.61

Negative values represent lumbar spine flexion and positive values represent lumbar spine extension.
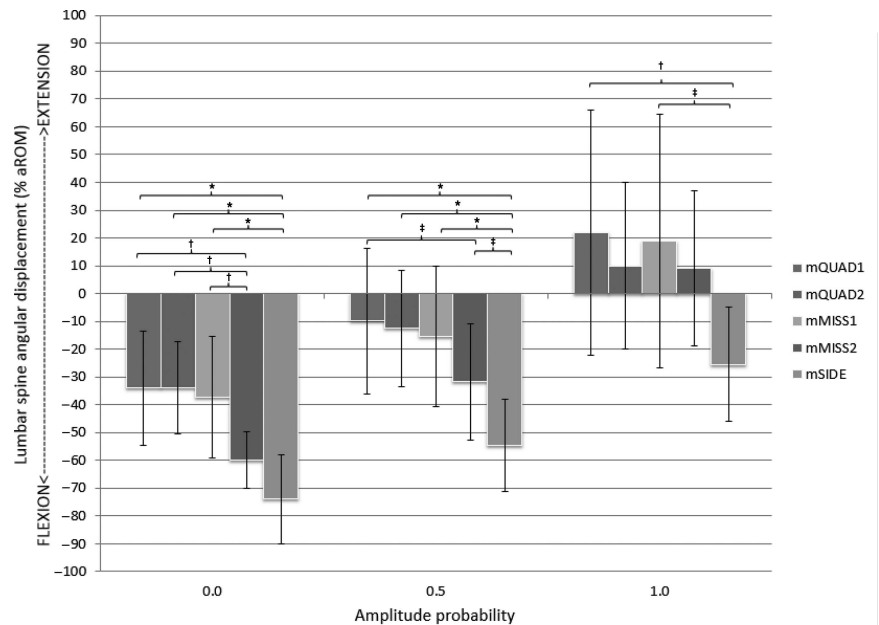
Figure 3. Histogram showing the means and standard deviations of average lumbar spine angular displacement (% aROM) at amplitude probabilities of 0.0, 0.5, and 1.0 across all coital positions. Statistical significance is represented by the following: *$P < 0.001$, †$P < 0.01$, ‡$P < 0.05$. aROM indicates active range of motion.

that if the loading of a structure exceeds its tolerance, damage to the structure will occur[11]—as well as the implicit contribution of motion to the load imposed on spinal structures[11]—the relevance of this study's findings to these subgroups may be a point in question. Marked improvement in patients' outcomes as a result of matching patients' signs and symptoms to their individualized treatment using an LBP subgrouping method has been reported by several groups.[12,13] A critical component of the success of this subgrouping and treatment method is the clinician's determination of motions and postures that elicit LBP during the physical examination and provocative testing and the avoidance of these motions and postures during the patient-specific treatment program.[12,13] In keeping with these well-established demonstrations of best clinical practice for the treatment of LBP,[14–16] once the clinician has appropriately subcategorized the patient's LBP, initial guidelines presented here (Figure 4) may guide the clinician as to which coital positions contain motions and postures that may exacerbate their patient's subgroup of LBP. This will help enable more comfortable coitus for the patients with respect to their LBP and ensure consistency with their treatment program that aims to avoid motions and postures that trigger their LBP.

In general, male coital movement mainly occurred in the sagittal plane of motion; however, no participants achieved 100% of their spine aROM at any point during a coitus trial. This initial observation supports impressions made from the magnetic resonance images of the anatomy of sexual intercourse in the work of Schultz *et al*[17,18]; although the lumbar spine was not specifically examined, the inherent repetitive flexion-extension movement was clearly seen in the midsagittal plane images. Therefore, the following discussion is most applicable to patients whose LBP is exacerbated by spine flexion (*i.e.*, flexion-intolerant), extension (*i.e.*, extension-intolerant), and motion (*i.e.*, motion-intolerant); a coital position is considered to be "spine-sparing" if the pain-provoking biomechanical variable (*i.e.*, a motion and/or a posture) is avoided.

For those patients who are classified as flexion-intolerant *via* provocative testing, both mSIDE and mMISS2 would be considered the least spine-conserving because they reached the highest percentages of and fluctuated over the widest range of spine flexion, respectively. Conversely, both variations of QUADRUPED, mQUAD1 and mQUAD2, would be considered the most spine-sparing of the positions studied,

TABLE 3. Lumbar Spine Angular Displacement (Degrees) by Coital Position for Specific Variables*

Variable	mQUAD1	mQUAD2	mMISS1	mMISS2	mSIDE
Absolute maxima	2.16 ± 8.55	0.77 ± 8.40	1.17 ± 16.40	0.17 ± 9.91	−16.17 ± 13.28
Absolute minima	−18.27 ± 12.63	−18.05 ± 12.92	−20.02 ± 15.61	−32.99 ± 13.85	−41.87 ± 14.43
Average	−7.14 ± 9.84	−8.21 ± 10.00	−9.35 ± 14.69	−16.76 ± 12.42	−30.97 ± 13.54
Average of local maxima	−1.08 ± 9.31	−7.67 ± 9.07	−1.52 ± 17.12	−4.67 ± 11.24	−23.10 ± 14.86
Average of local minima	−10.23 ± 14.58	−15.80 ± 12.20	−16.23 ± 15.11	−28.14 ± 13.82	−38.47 ± 14.69

Negative values represent lumbar spine flexion and positive values represent lumbar spine extension.

AVOID

Flexion-intolerant ⟷ Extension-intolerant

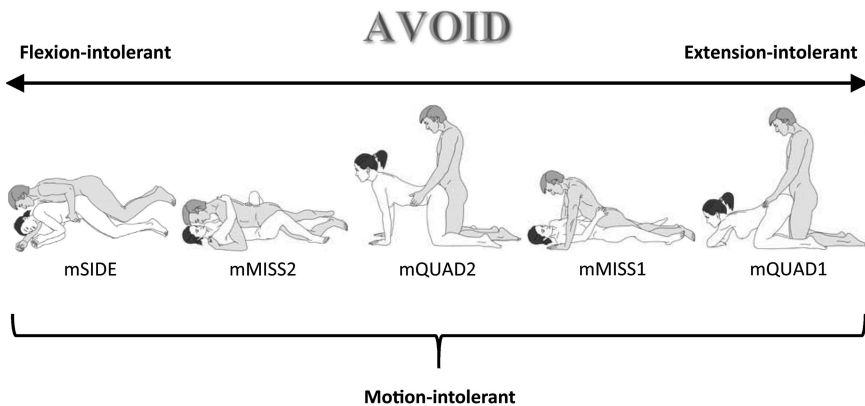mSIDE   mMISS2   mQUAD2   mMISS1   mQUAD1

Motion-intolerant

Figure 4. Initial recommendations of coital positions to *avoid* for male patients whose low back pain is exacerbated by specific movements and/or postures (*i.e.*, flexion-, extension-, and motion-intolerance). Positions indicated as "to avoid" are those that present the greatest risk of exposure to the pain-provoking biomechanical variable, thus exacerbation of low back pain. Note: These recommendations are limited to specific motion intolerances and male-centric positions and did not consider kinetics nor include individuals experiencing pain.

followed by mMISS1. Although spine angular displacement during mQUAD2 remained within the flexion range, motion occurred through the least range. Hence, this would be contraindicated for the extension-intolerant patient. When advising the motion-intolerant patient, not one position included in this study would be recommended; however, coaching a hip-hinging technique[19] to these patients may alter the spine kinematic profile in the positions so that coital movement is more hip-dominant, thus spine-sparing. This technique may also be beneficial for the flexion- and extension-intolerant patient, but the effectiveness of this movement pattern intervention will require further investigation. These findings provide a biomechanical explanation for patient reports on mechanical factors exacerbating LBP during coitus and contributing to reduced coital frequency.[1,8]

It is interesting to note that a seemingly subtle change in posture—for example, the male supporting his upper body with his elbows (mMISS2) or his hands (mMISS1) during different variations of MISSIONARY—altered the spine kinematic profile significantly; mMISS1 was among the more spine-conserving coital positions and mMISS2 was among the least for flexion-intolerant patients. Even a slight adjustment in the female partner's posture—for example, the female supporting her upper body with her elbows (mQUAD1) or her hands (mQUAD2) during different variations of QUADRUPED—affected the male spine kinematic profile. Our data (not presented here) show that the female partner achieved greater extension in mQUAD2 than in mQUAD1, so it is possible that the female spine posture affects the penetration angle and preferential contact of the penis.[20] This suggests that the partner may be an integral factor in the intervention; however, this relationship requires further investigation.

Our findings and initial recommendations contradict the most frequently advised coital position for both male and female patients with LBP: the side-lying position.[9,21] This may be due to conflicting biomechanical rationales influencing the development of recommendations. For example, White and Panjabi[9] propose side-lying as the "best basic position for either partner with LBP," because flexing at the hips and knees would relax the psoas and sciatic nerve, straightening the spine, and reducing a disc bulge; however, current research on intervertebral disc mechanics,[22] commonly used tests for

sciatic nerve tension in the clinical setting,[19] and our results for mSIDE have shown the contrary. All other recommendations currently available for patients with LBP are based on conjecture, clinical experience,[23] or popular media resources.[24,25] Many health care practitioners feel uncomfortable discussing their client's sexual needs or do not address these needs at all[26]—perhaps the provision of recommendations qualified with empirical data will not only substantiate their clinical advice but also facilitate dialogue between health care practitioners and their patients regarding this important issue.

Limitations

This analysis was limited to males, specific motion intolerances, and male-centric coital positions (due to instrumentation constraints). Expanding this biomechanical analysis of coitus to include female-centric positions, other motion and posture intolerances, and load intolerances will further the development of recommendations.

CONCLUSION

The role of the clinician is to assess the motions and postures that trigger LBP in the patient. Subsequently, the data provided here may guide the clinician's specific recommendations to the male LBP patient, including specific coital positions and movement strategies, to avoid the LBP triggers during coitus.

Future directions in the area of coitus biomechanics may address female-centric positions, populations experiencing pain (*e.g.*, LBP), and effectiveness of movement pattern (*e.g.*, hip-hinging) and posture adjustment (*e.g.*, lumbar support)–based interventions.

> ➢ **Key Points**

❑ The success of this data collection demonstrates that a biomechanical analysis of coitus is feasible.

❑ Male spine movement, in the positions analyzed, is predominantly in the sagittal plane of motion (*i.e.*, flexion/extension).

❑ Based on range of motion, the least to most recommended for a male flexion-intolerant

patient are mSIDE, mMISS2, mQUAD2, mMISS1, and mQUAD1.

❑ Motion-intolerant patients are recommended to alter their coital movement from spine-dominant to hip-dominant.

❑ Subtle changes in either partner's posture may affect the spine kinematic profile of the male—the partner may aide in the intervention.

Acknowledgments

References

1. Maigne J, Chatellier G. Assessment of sexual activity in patients with back pain compared with patients with neck pain. *Clin Orthop Relat Res* 2001;385:82–7.
2. Akbas NB, Dalbayrak S, Külcü DG, et al. Assessment of sexual dysfunction before and after surgery for lumbar disc herniation. *J Neurosurg Spine* 2010;13:581–6.
3. Stock SR, Cole DC, Tugwell P, et al. Review of applicability of existing functional status measures to the study of workers with musculoskeletal disorders of the neck and upper limb. *Am J Ind Med* 1996;29:679–88.
4. Fairbank JC, Couper J, Davies JB, et al. The Oswestry low back pain disability questionnaire. *Physiotherapy* 1980;66:271–3.
5. International Classification of Functioning, Disability and Health (ICF). World Health Organization (WHO) Web site. Available at apps.who.int/classifications/icfbrowser/. Published May 22, 2001. Accessed April 9, 2011.
6. Berg S, Fritzell P, Tropp H. Sex life and sexual function in men and women before and after total disc replacement compared with posterior lumber fusion. *Spine J* 2009;9:987–94.
7. Monga TN, Monga U, Tan G, et al. Coital positions and sexual functioning in patients with chronic pain. *Sex Disabil* 1999;17:287–97.
8. Sjögren K, Fugl-Meyer AR. Chronic back pain and sexuality. *Int Rehabil Med* 1981;3:19–25.
9. White AA, Panjabi MM. *Clinical Biomechanics of the Spine*. 2nd ed. Philadelphia, PA: J.B. Lippincott Company; 1990.
10. Hagberg M. The amplitude distribution of surface EMG in static and intermittent static muscular performance. *Eur J Appl Physiol* 1979;40:265–72.
11. National Research Council and the Institute of Medicine. *Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities*. Panel on Musculoskeletal Disorders and the Workplace. Commission on Behavioural and Social Sciences and Education. Washington, DC: The National Academies Press; 2001.
12. Brennan GP, Fritz JM, Hunter SJ, et al. Identifying subgroups of patients with acute/subacute "nonspecific" low back pain. *Spine* 2006;31:623–631.
13. Ikeda DM, McGill SM. Can altering motions, postures, and loads provide immediate low back pain relief: a study of 4 cases investigating spine load, posture, and stability. *Spine* 2012;37:E1469–75.
14. Hoppenfeld S. *Physical Examination of the Spine and Extremities*. Norwalk, CT: Appleton-Century-Crofts; 1976.
15. Liebenson C. *Rehabilitation of the Spine: A Practitioner's Manual*. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2007.
16. Magee DJ. *Orthopedic Physical Assessment*. 5th ed. St. Louis, MO: Saunders Elsevier; 2008.
17. Schultz WW, van Andel P, Sabelis I, et al. Magnetic resonance imaging of male and female genitals during coitus and female sexual arousal. *Br Med J* 1999;319:1596–600.
18. Human sex from the inside out. New Scientist Web site. Available at http://www.newscientist.com/article/dn17662-human-sex-from-the-inside-out.html. Published August 21, 2009. Accessed October 29, 2011.
19. McGill SM. *Low Back Disorders*. 2nd ed. Champaign, IL: Human Kinetics; 2007.
20. Faix A, Lapray JF, Courtieu C, et al. Magnetic resonance imaging of sexual intercourse: initial experience. *J Sex Marital Ther* 2001;27:475–82.
21. Osborne D, Maruta T. Sexual adjustment and chronic back pain. *Med Aspect Hum Sex* 1980;14:94–113.
22. Scannell JP, McGill SM. Disc prolapse: evidence of reversal with repeated extension. *Spine* 2009;34:344–50.
23. Rubin D. The no!—or the yes and the how—of sex for patients with neck, back, and radicular pain syndromes. *Calif Med* 1970;113:12–5.
24. Hebert L. *Sex and Back Pain*. Bloomington, MN: Educational Opportunities; 1987.
25. White AA. *Your Aching Back: A Doctor's Guide to Relief*. 2nd ed. New York, NY: Simon & Schuster/Fireside; 1990.
26. Pynor R, Weerakoon P, Jones MK. A preliminary investigation of physiotherapy students' attitudes towards issues of sexuality in clinical practice. *Physiotherapy* 2005;91:42–8.