Executive Summary

Low back pain (LBP) is very common and a major cause of disability worldwide, especially among people who work in office-based, computer-focused jobs. Many people believe that "too much sitting" causes back pain, but research to confirm this statement so far has been unclear, partly because most studies have relied on people remembering and reporting how long they sit, rather than measuring it directly. This project was designed as a feasibility study to see whether it is practical and acceptable to use wearable sensors to objectively measure sitting time, posture, and spine movement in real life, and to link these measures with back pain and back function over a typical workday and overnight. This moves ability to better research this problem forward, while at the same time gaining important insights on the immediate effect workday and leisure sitting has on markers of back function.

The study had two main goals. First, to test whether the study design works in practice: can we recruit office workers, ask them to wear sensors for extended periods, and complete repeated lab tests without too much burden? We can use that information to design stronger, more efficient studies in the future. Second, to explore, in a preliminary way, whether sitting behavior and spinal posture might be related to changes in back pain and back function over the course of a day and overnight. This information helps us better understand the mechanisms at play between the physical posture of sitting and both the experience of pain and functional ability of the back.

What We Did

Thirty adult office workers (18+ years) whose jobs mainly consist of desk-based work were recruited from the local community and university. They attended three lab sessions over 24 hours:

- Morning (before work): baseline pain rating and a set of back function tests (e.g., spine height, flexibility, back muscle endurance, spine movement, and muscle reflexes).
- End of workday: pain rating and repeat back function tests.
- Next morning: pain rating and a final round of back function tests to see how well the back recovered overnight.

During this time, participants wore three small sensors on their upper back, lower back, and thigh. These devices recorded movement and posture. We used them to calculate how much time they spent sitting, standing/walking, or lying, and how their spine angle changed while sitting. Participants also filled out a short activity diary and rated their back pain at several points: before work, midday, after work, before bed, and the next morning. After the 24-hour protocol, they were invited (but not required) to continue wearing the sensors for another six days. They also completed questionnaires about how acceptable and comfortable they found the study procedures.

Feasibility (i.e., is it possible, practical, worthwhile?) was evaluated using several indicators: participant recruitment and retention rates, attendance at lab sessions, adherence to wearing the sensors, reports of adverse events (such as skin irritation), and questionnaire ratings of acceptability. We also looked at participants' open-ended feedback to identify what worked well from their perspective and what should be improved in future studies.

Feasibility: What Worked and What Didn't

From a feasibility point of view, the study was largely successful. Most people who expressed interest participated in the study, and all 30 participants completed the 24-hour protocol and all three lab visits, showing very strong retention and engagement. Short-term sensor wear was excellent: everyone wore the devices for the full first day. Participants also reported that the

instructions were clear and that attending the lab sessions was acceptable. Most said the devices did not interfere much with their daily activities, especially at home, and almost all said they would recommend these procedures for future occupational sitting studies.

However, there were clear limits. Only about one in five participants chose to keep wearing the sensors beyond the first 24 hours. The main reason was mild skin irritation from the adhesive pads, especially on the back and around clothing contact points. Some participants also found it uncomfortable to sleep with the sensors on. These issues suggest that while one-day monitoring with adhesive-mounted sensors is very feasible, continuous week-long monitoring in the same way is more challenging and will require improved sensor design or different wearing schedules in future studies (for example, monitoring on non-consecutive days).

Early Findings: Sitting, Pain, and Back Function

While the main aim was feasibility, the data also allowed us to make some exploratory observations about sitting patterns, pain, and back function:

- Participants were grouped based on whether their back pain increased by 2 or more points (on a 0–10 scale) from before work to after work: Pain Developers (PDs) and Non-Pain Developers (NPDs) - those with little or no change. In total, 19 people were NPDs and 11 people were PDs.
- At work, PDs spent more total time sitting and a greater percentage of their workday in a sitting posture compared with NPDs. Both groups took breaks and changed posture, but PDs tended to have longer uninterrupted sitting bouts and appeared less “dynamic” in their posture overall.

- During leisure time, total sitting minutes were similar between groups, but NPDs spent more of their evening standing or walking, while PDs spent more time lying down. This suggests that people who developed pain at work may have been more likely to "crash" and rest in very sedentary positions after work, while those without pain stayed a bit more active.
- When we looked more closely at back posture during sitting, the overall distribution of lumbar flexion angles (how bent the lower back was) was broadly similar between groups across the range of small to large angles. The data hinted that PDs might sit in a more narrow, static range of postures while NPDs showed slightly more variation, but these trends did not reach statistical significance and must be treated as preliminary.
- Pain over time followed different patterns. In PDs, pain tended to build gradually across the workday, eased somewhat before bed, but stayed above baseline even the next morning. In contrast, NPDs had very little change in pain at any point. A few individuals showed delayed pain that only appeared in the evening, reminding us that discomfort can develop after leaving work, not just during the shift.
- We also saw measurable but modest and reversible changes in back function across the three time points. They fit with the idea that a typical workday of sitting can load the spine and muscles but, in many cases, the body can recover overnight. Further, our findings suggest that some people experienced more pain and may recover less completely, which could matter over longer periods.

Strengths and Limitations

This study has several important strengths. It is one of the few to combine objective, continuous sensor data on sitting and posture with lab-based tests of back function in a real-world office

setting. It looked at both work and leisure time over 24 hours, rather than just what happens at the desk, and it went beyond "total sitting hours" to examine how people sit and how much they move. A notable strength is the active involvement of a participant partner, who helped shape the protocol to be both scientifically sound and participant-friendly and will help share results in accessible language.

As a feasibility study, there are also clear limitations. The sample was small and recruited by convenience, so the findings cannot be generalized to all office workers. Most monitoring focused on a single workday, so we do not know how typical that day was or how patterns might change across more time. The study was observational, so we cannot say that certain sitting patterns caused pain — other factors such as pre-existing pain, stress, sleep, or workload may also be important. Skin irritation from adhesives reduced willingness to wear sensors for longer periods, highlighting a practical barrier for multi-day monitoring. We also did not measure sleep quality or posture during sleep, factors we know can play a role in overnight recovery.

In summary, this feasibility study demonstrates that it is possible to objectively measure how office workers sit and move in daily life, and to link that exposure to pain and back function. The early findings suggest that how long we sit, how often we move, and how we spend our leisure time may all play a role in back pain. At the same time, the results are not definitive and should be viewed as a starting point. These underscore the need for larger and longer studies to test cause and effect more rigorously. The findings of this study provide a solid foundation and clear directions for future research aimed at developing practical, evidence-based strategies to reduce the risk of LBP in office workers.