Journal of Science & Cycling
Breakthroughs in Cycling & Triathlon Sciences

OPEN ACCESS

Communication

Anterior saddle conflict in women cycling : a case study

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Abstract: Women's cycling is growing rapidly, but as it is a recent development, women do not always find products that are suitable for them. It is well known that women are particularly sensitive about their seating position on the bike and have difficulties in finding the right saddle. The choice of saddle is often made by default. We have noticed that an unsuitable saddle can cause the pelvis tilt, as if to avoid resting on an irritating spine. The aim of our case study was to investigate the effects of a custom-made saddle against an anterior saddle conflict that had been going on for several years. Our subject is an international female cyclist who rides for a UCI Women Continental team. She had unilateral vulvar lymphoedema and knee pain on the same side. She was already wearing orthopaedic corrections to stabilise her position on the bike. The stability gain was partial. Knee and seat pain remained. We compared the athlete's original saddle with the custom-made saddle without foam and with foam. Kinematics, kinetics, saddle pressure and comfort perception were measured while riding at 70-75% of estimated MAP and with 2 different cadences: 90-95rpm (power) and 70-75rpm (strength). The bearing surface of the saddle increased significantly. The maximum saddle pressures were reduced. The distribution of lateral and anteroposterior pressures was clearly rebalanced. The saddle was perceived to be clearly comfortable. However, no changes could be detected in the kinematics and kinetics of pedalling. This case study seems to verify that material-specific saddle conflict is a reality. The custom-made saddle could be a solution to this indication. The advantages and disadvantages of the different customised techniques are however still to be studied, as well as the effect they could have on a larger group.

Keywords: Saddle, Pelvis Tilt, Women Cycling, Vulvar Lymphoedema.

Introduction

Last years, women cycling became consistently more popular and it should not stop with the arrival of the women Tour de France. Not only the quantity of practitioners increased but also the races distances and the level of performance. With this development, pathologies also arrived.

Injuries are commonly the same between men and women but we notice more sensibility around the saddle area and more pelvis instability. For women, the pelvis instability and so the frictions on the saddle can cause a direct pathology, a vulvar lymphoedema (Humphries, 2002), or indirect pathologies, cause of a bad alignment of the limb.

About the pelvis instability, it is important to consider the saddle height above all. When the saddle is too high, the pelvis instability increases (Leavitt et al, 2016). But sometimes, we can have pelvis instability even with a good or low saddle height.

Bouillod et al. (2017 et 2020) showed an improvement in gross efficiency, in drag area and in perceived comfort with customed foot orthotics and by compensating a Lower Limb Length

Inequality (LLLI), via a decrease in the pelvis movements.

However, we can meet women cyclists with a pelvis instability even after a bike fitting or using orthotics insoles, without clinical explanations.
We suppose that inappropriate saddle could cause an irritative spine when sitting, and cause pelvis instability.
The goal of this study is to investigate the effects of a custom-made saddle when there is a saddle conflict. We expect to delete the irritative spine by increasing the bearing surface and so to stabilize the pelvis on the saddle, to improve the comfort on the saddle and to stop the related injuries.

Materials and Methods

Subject

Our study was designed as a case study. The subject was a woman international rider, competing the Worlds Championships and riding for UCI Women Continental Team.
She has an unilateral vulvar lymphoedema. She is suffering from this region while riding a bike and has knee issues on the same side.
She describes a pain on the anterior part of the saddle.
She has pelvis instability although she already has LLLI compensation and orthotics insoles.

Methodology

One month before the testing session, the subject received a saddle print kit. The sitbone width and radius were measured. A description of the troubles was asked, as the localisation of the troubles on the saddle. A photo of the subject riding, profile view, was also requested, to consider the position of the cyclist.

Kinematics, kinetics, saddle pressure and comfort perception were measured while riding at 70-75% of estimated MAP and with 2 different cadences : 90-95rpm (power) and 70-75rpm (strength).
Datas were recorded for 3 differents saddles : (1) the original saddle, (2) the customized saddle without foam and (3) the customized saddle with foam.

Materials

Kinematics were measured by the Cycling 3DMA solution, from STT Systems.
Kinetics were measured by the Pedaling Analyzis, from Bikefitting.com.
Saddle pressure by the Gebiomized technology.
Comfort perception was measured with a scale from 0 (minimum comfort) to 10 (maximum comfort). The overall comfort of the saddle was rated but also for divided zones : pubis, perineum, right border, left border, right sitbone, left sitbone.

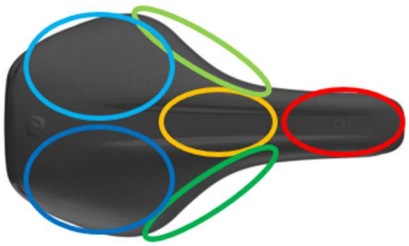

Figure 1 : Zones for the perceived comfort collect

Results

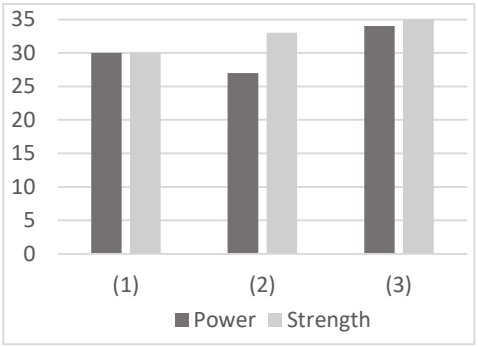

Figure 2 : Percentage of the bearing surface on the saddle total surface.

One of the expectations was to increase the bearing surface on the saddle with the use of a customized saddles. Figure 2 shows that the customized saddle with foam (3) increases the percentage of the bearing surface on the saddle total surface of 13% in power cadence and 17% in strength cadence.

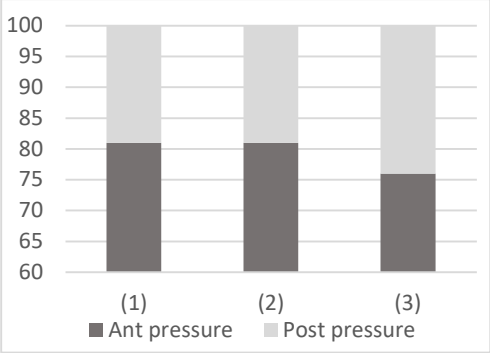

Figure 3 : Anteroposterior repartition of the pressure on the saddle with power cadence.

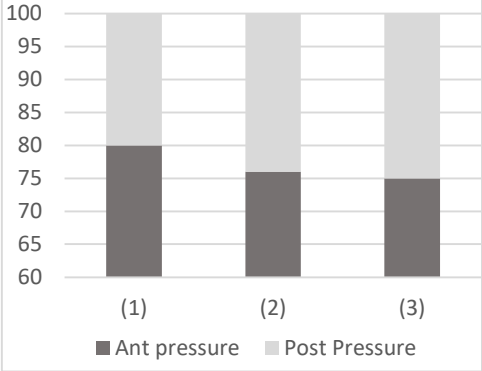

Figure 4 : Anteroposterior repartition of the pressure on the saddle with strength cadence.

Figures 3 and 4 show a decrease of 10% of the difference between anterior and posterior pressure on the saddle when using the (3), with boss power and strength cadences, compared to saddle (1).
Wa can note that the saddle (2) reduces of 8% the difference between anterior and posterior pressure.

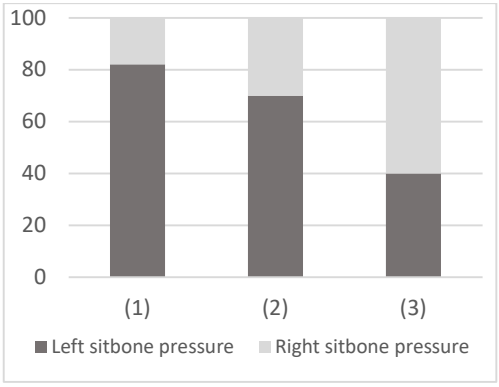

Figure 5 : Lateral repartition of the pressure on the saddle with power cadence.

Figures 5 and 6 show a net improvement of the pressure balance on the saddle, using the customized saddle (2 and 3).
During power cadence session, fhe lateral pressure difference was about 64% on saddle (1). It is reduced to 40% with saddle (2) and 20% with saddle (3).
During strength cadence session, the lateral pressure difference was about 72% on saddle (1). It is reduced to 32% with saddle (2) and 8% with saddle (3).
With the foam, the lateral repartition of the pressure is even reversed, with more pressure on the right sitbone than on the left.

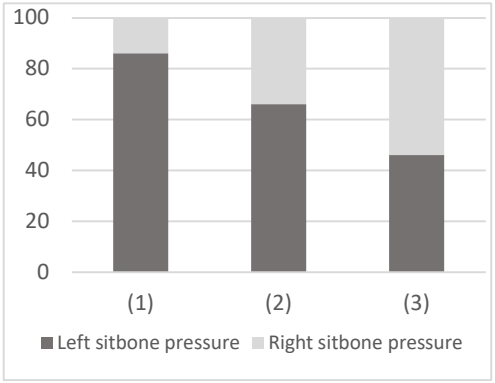

Figure 6 : Lateral repartition of the pressure on the saddle with strength cadence.

Figure 7 : Maximal pressures applied on the saddle with power cadence.

Figure 7 shows that during power cadence session, the saddle (2) reduced the maximum pubic pressure by almost 20% compared to the saddlee (1). The (3) reduced the pubic pressures by almost 45% compared to the (1 and by almost 31% compared to the (2).
At the same time, the maximum pressure on the right ischium increased. Compared to saddle (1), it is almost 3 times greater in the (2) and almost 6 times greater in the (3).
Conversely, the maximum pressure on the left ischium has decreased. Compared to saddle (1), it is 17% lower 17% lower with the (2) and 14% lower with the (3).

Figure 8 : Maximal pressures applied on the saddle with force cadence.

Figure 8 shows that saddles (2) and (3) reduced the maximum pubic pressure by almost 25% compared to the (1).

At the same time, the maximum pressure on the right ischium increases. Compared to saddle (1), it is 1.6 higher in the (2) and almost 5 times higher in the (3).
Conversely, the maximum pressure on the left ischium has decreased. Compared to saddle 1, it is 13% lower in the (2) and 18% lower in the (3).

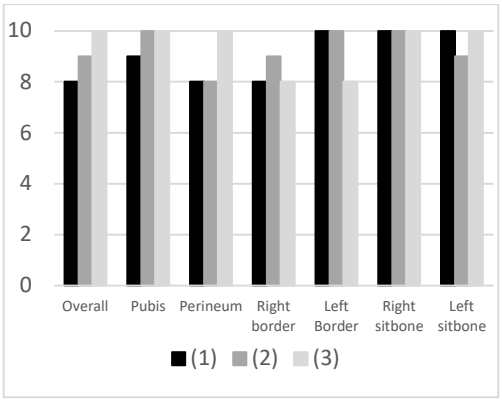

Figure 9 : Perception of the saddle comfort with power cadence.

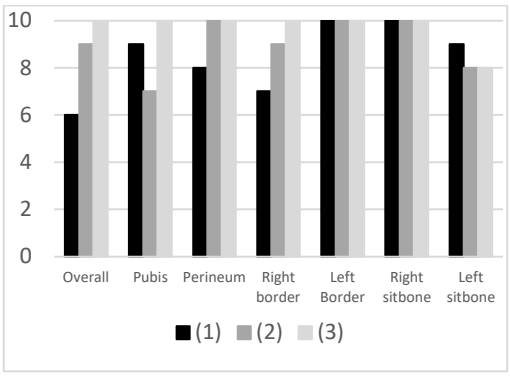

Figure 10 : Perception of the saddle comfort with strength cadence.

Figures 9 and 10 illustrate the saddle comfort perceived with the different saddles. The overall rating indicates that the saddle (2) is betther than the (1) and that the saddle (3) is better than the (2).
Saddle (3) has the maximal note, except the borders with power cadence situation, and except the left sitbone with strength cadence.
The saddle (3) is the only one improving the pubis confort in both situation power and strength cadence.

Discussion

The aim of the study was to investigate the effect that can have a customized saddle on women cyclist with an irritative spine on the saddle.
We supposed that a customized saddle would delete the irritative spine by increasing the bearing surface on the saddle. The analysis of the objective and subjective data indicates that this theory works in this case study. It would be interesting to repeat this study with several subjects in the same situation. With a larger group, effects of kinematics and kinetics could be measurable.

The customized saddle without foam (2) looked to have less effects than with foam (3) on power cadence, which is a recommended cadence in cycling (90-95rpm). We should consider the importance of the foam when searching a saddle.
The saddle was adapted here in the engineering of the saddle in addition to the impressions. We suppose that both have an effect but it would be interesting to quantify the effects of each one.
There are also different way to take the impression : indirect, with measurement as it was done here ; or direct, with a molding. It would be interesting to compare the advantages and disadvantages of each method.

In a future study, it could be interesting to collaborate with doctors and gynaecologists, to have a professional analyse of the vulvar lymphoedema. From the perception of the athlete, the vulvar lymphoedema has reduced and is not injured as it was before. The knee is also less sensitive.

Practical Applications.

Many women cyclists are used to injure themselves or are desperate to find a good saddle. This study shows the interests of a customized saddle for women with pathologies.
study makes the problem of the saddle in women cyclists central.
Finally, this study calls into question the saddles supposedly intended for women currently on the market.

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