Invacare Matrx Libra®

Clinical Evidence

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Introduction

The Matrx Libra cushion is designed to optimise each of the following three features, offering the highest level of skin protection and positioning, even for users with previous or existing skin breakdown.

Immersion

- The surface area on the Matrx Libra cushion is maximised thanks to its specially moulded anatomical shape; includes a contoured pelvic well, a waterfall front edge allowing full length thigh support without compromising the popliteal area, and rear cushion radius for support and contour behind the pelvis.

Off-loading

- The pelvic well on the Matrx Libra has been designed with a raised trochanteric shelf to elevate the pelvis, prevent the ischial tuberocities from bottoming out through the fluid sac and redistributing forces away from the sensitive bony prominences to the hips and thighs.

Envelopment

- The Matrx Libra has a unique three chamber fluid sac that has been designed with **Flo-tech™** technology; a lower continuous section for maximum conformity and a divided top layer to prevent migration of the fluid. The non-temperature sensitive silicone fluid provides a consistent performance in all climates and requires no kneading or maintenance. The silicone fluid provides exceptional dynamic shear reduction.

Cushion construction

- **The Matrx Libra** provides superior postural support and stability, and requires no ongoing maintenance in order to perform as designed. The foam base is constructed of highly durable and lightweight HR foam made with **Ultra-Fresh™** for antimicrobial and odour control. Three cover options are available to optimise micro-climate and moisture protection.

Shear Management

The Matrx Libra cushion provides optimal shear reduction by addressing both static and dynamic shear without compromising posture.

Dynamic:

Flow of materials reduces tension between bony prominences and tissues during functional activities, wheelchair propulsion, and accommodates movement within a specific range.

Static:

Support surface contour that prevents sliding and downward migration of the pelvis.

Adjustability

There are a number of accessories available that allow **The Matrx Libra** cushion to be modified (customised) to accommodate or correct postural issues or postural changes over time.

Anterior (front) wedge(s)

- Use on both sides to help prevent sliding
- Use on one side only to facilitate foot contact on the low side and foot support on the high side e.g. Hemiplegic client

Tapered wedge(s)

- Use under front corner to encourage adduction
- Use under rear corner to address pelvic obliquity

Lateral (side) wedge(s)

- Can be used to create a deeper contour

Supplementary fluid sac

- Secure by threading on to the lateral strap of the fluid overlay and position on the trochanteric shelf (not in well)
- Can be used to address pelvic obliquity alone or in combination with a tapered wedge, or bilaterally to create a deeper contour

Clinical Evidence

Several independent studies have been completed over the past few years on **the Matrx Libra** cushion and we have highlighted them in this booklet, for ease of reference. Over the next few pages, you will find an overview of each of the studies mentioned below:

- Assessment of the Change in State of Health in Reference to Different Postural Support Systems: Outcome of Research
- Evaluation of pelvis postural systems in spinal cord injury patients: Outcome of research
- Libra Wheelchair Cushion Testing for PDAC Human Subject Test Adjustable Skin Protection and Positioning

1 Assessment of the Change in State of Health in Reference to Different Postural Support Systems: Outcome of Research

AUTHORS: Mariele Colucci, Rita DeSantis, Giovanni Galeoto and Maria Grazia Soave

PUBLISHED: Sapienza Università, Di Roma

DATE: 2014/2015

a Study aim and design

- The main aim of this study was to understand how different wheelchair cushions (postural systems) may have an impact on users' occupational performance and how this affects the overall state of health and quality of life.

The subject population for this study included nine wheelchair users (N=9; 55% males, 45% females) recruited at the Occupational Therapy Clinic of the Physiatrist Department of the General Hospital of Rome Umberto I.

The sample selection was recruited regardless of their pathology, since the objective was to categorise wheelchair cushions based on their individual characteristics and highlight which one provided a good compromise regarding comfort, pressure redistribution, stability, posture, lightness, temperature, adaptability to movement and activities.

This study considered the following cushions to be tested: **Roho Contour Select** (air cushion); **Invacare Matrx Libra** (pre-shaped foam cushion with fluid bag); **Jay Balance** (pre-shaped foam cushion with fluid bag).

Table 1 - Overview of the 4-week trial process

FIRST MEETING	SECOND MEETING	THIRD MEETING	FOURTH MEETING
▸ Project presentation; ▸ Signing of informed consent regarding generic risks and personal data processing. ▸ Postural assessment in seated and supine position. ▸ First cushion test: Pressure-mapping data collection of the cushion in static state and in dynamic state on a 40 m straight line; Observation of seated posture after the activity.	▸ Compiling questionnaires relevant to the degree of satisfaction and health state for the cushion used during week 1. ▸ Tested cushion returned. ▸ Second cushion test: Pressure-mapping data collection of the cushion in static state and in dynamic state on a 40 m straight line; Observation of seated posture after the activity.	▸ Compiling questionnaires relevant to the degree of satisfaction and health state for the cushion used during week 2. ▸ Tested cushion returned. ▸ Third cushion test: Pressure-mapping data collection of the cushion in static state and in dynamic state on a 40 m straight line; Observation of seated posture after the activity.	▸ Compiling questionnaires relevant to the degree of satisfaction and health state for the cushion used during week 3. ▸ Tested cushion returned. ▸ Data collection on subjects' opinions on the different cushions used for the test.

Materials and methods

▸ A **BodiTrak** package and **FSA system** were used to collect data in static and dynamic positions and register for each cushion test, per subject, the following values: minimum pressure, maximum pressure, average between the various points of the sensor, variance, standard deviation, variation coefficient (in percent), horizontal and vertical pressure centre (in centimetres).

A postural assessment considering the clinical situation and needs of the subject was carried out to collect a series of data that included the diagnosis, skin condition, possible surgeries, use or not of orthoses or braces, cognitive aspect, visual-auditory characteristics and how transfers are performed.

Subjects' seated position in the wheelchair was also analysed, using the following anatomical points and posture as a reference: pelvis, shoulder girdle and upper limbs, torso and lower limbs. A specific Postural Assessment Form was used to register all this data.

SF-12 was submitted three times to each subject (after the weekly trial of each cushion) **to assess the impact of each wheelchair cushion on the state of health** (from a physical and mental viewpoint).

To complete the wheelchair cushion assessment, a questionnaire was formulated using the subject at the centre of the decision-making process, by researching his/her opinion regarding:

- Stability
- Temperature (perspiration and accumulation of heat)
- Adaptability to movement and activities
- Ease of transfers wheelchair-bed/bed-wheelchair
- Stability during limited personal hygiene activities (shaving/applying makeup, face washing and tooth brushing)

For each parameter, an opinion was requested based on the following scale: Completely Satisfied; Fairly Satisfied; Not Sure; Fairly Unsatisfied; Completely Unsatisfied.

Key results

Pressure reading

b

▶ **Table 2 and 3 shows the average pressure readings of the three cushions in two different situations.** Static (data measured after 30 seconds from sitting on the surface) and Dynamic (data measured during propulsion).

Table 2 -
Average pressure exercised on the three cushions after 30 seconds from sitting on the surface.

	Roho Contour Select	Invacare Matrx Libra	Jay Balance
Average Pressure (mmHg)	32.45 (SD 7.21)	31.35 (SD 10.53)	30.93 (SD 9.72)
Horizontal Pressure Centre (cm)	21.13 (SD 1.65)	22.38 (SD 2.62)	21.51 (SD 2.35)
Vertical Pressure (cm)	22.76 (SD 5.05)	24.05 (SD 4.56)	23.68 (SD 4.38)

Table 3 -
Average pressure exercised on the three cushions during propulsion.

	Roho Contour Select	Invacare Matrx Libra	Jay Balance
Average Pressure (mmHg)	40.26 (SD 11.27)	40.85 (SD 12.75)	36.74 (SD 10.36)
Horizontal Pressure Centre (cm)	21.76 (SD 1.49)	22.56 (SD 1.44)	21.93 (SD 1.49)
Vertical Pressure (cm)	24.20 (SD 4.87)	25.04 (SD 4.27)	23.68 (SD 4.38)

Postural assessment

▶ **The application of a Postural Assessment form, focused on several points (e.g. subject general data collection, neurological profile; mobility equipment used).** Table 4 outlines the average body alignment of subjects' body segments, with each cushion, while seated on the wheelchair.

Invacare Matrx Libra was the cushion that scored best for the position of the pelvis, having a direct influence on the position of spine, shoulder and head.

Table 4 - Average alignment of subjects' body segments.

	Roho Contour Select	Invacare Matrx Libra	Jay Balance
Head	100%	100%	100%
Shoulders	55%	88%	77%
Torso	44%	77%	77%
Pelvis	11%	66%	55%
Lower limbs	77%	77%	88%

State of Health (SF-12) Questionnaire

▶ **Table 5 summarises the results achieved through the application of SF-12 Questionnaire.** Highest scores will mean better general health condition. Results show that Invacare Matrx Libra was the cushion that performed better.

Table 5 - SF-12 Questionnaire results.

	Roho Contour Select	Invacare Matrx Libra	Jay Balance
PCS (concepts relevant to physical morbidities)	34.42 (SD 10.29)	38.76 (SD 8.89)	35.84 (SD 11.16)
MCS (morbidities and psychological and mental etiologies)	53.16 (SD 4.01)	56.52 (SD 7.01)	46.87 (SD 8.05)

Wheelchair Cushion Subject Satisfaction Questionnaire

Table 6 summarises the average score achieved per item assessed. The highest score a cushion would be able to achieve per item is 5 (completely satisfied) and 30 in total.

Invacare Matrx Libra achieved the highest average total score and stood out for balance, body heat, adaptability to movement and activities, stability during propulsion and A.D.L.

Table 6 -
Wheelchair Cushion Subject Satisfaction Questionnaire results.

	Roho Contour Select (mean ± SD)	Invacare Matrx Libra (mean ± SD)	Jay Balance (mean ± SD)
Balance	3.22 ± 1.20	4.22 ± 0.97	4.00 ± 0.70
Body heat	3.88 ± 0.60	4.00 ± 1.22	3.88 ± 0.60
Adaptability to movement and activities	3.66 ± 1.22	3.88 ± 1.16	3.44 ± 1.13
Easiest transfer in/out of wheelchair	4.00 ± 1.11	4.00 ± 0.70	3.77 ± 1.30
Stability during propulsion	3.44 ± 1.13	4.22 ± 0.66	4.00 ± 0.70
Stability during A.D.L.	4.00 ± 1.13	4.00 ± 0.78	3.55 ± 0.72
TOTAL	**22.20 ± 4.47**	**24.32 ± 3.45**	**22.64 ± 4.03**

Key findings

- Postural analysis results indicated that the Matrx Libra provided superior pelvic and shoulder alignment.

Pressure mapping results were generally comparable between the products evaluated. Results also indicated that the subjects' posture was maintained better following activity on the Matrx Libra cushion. Regarding user satisfaction following a one-week trial period on each cushion, in every category, scores indicated greater user satisfaction with the Matrx Libra cushion. It was reported that following the study period, seven of the nine users indicated that they would select the Matrx Libra cushion as their product of choice.

- **Note: If you would like to have access to the full study, please contact us.**

2 Evaluation of pelvis postural systems in spinal cord injury patients: Outcome of Research

AUTHORS: Serena Dattoli, Mariele Colucci, Maria Grazia Soave, Rita De Santis, Leandro Segaletti, Claudia Corsi, Marco Tofani, Donatella Valente and Giovanni Galeoto.

PUBLISHED: The Journal of Spinal Cord Medicine, DOI: 10.1080/10790268.2018.1456768

DATE: 2018

Study aim and design

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- Compare three commercial wheelchair cushions to determine the best for treatment of patients suffering from spinal cord injury below the cervical spine.

The subject population for this study included **13 wheelchair users** (N=13 84.6% males, 15.4% females) recruited at the Occupational Therapy Clinic of the Physiatrist Department of the General Hospital of Rome Umberto I and Occupational Therapy Clinic of "CPO" Hospital in Ostia.

This study considered the following cushions to be tested: **Roho Contour Select** (air cushion); **Invacare Matrx Libra** (foam cushion with fluid bag); **Jay Balance** (foam cushion with fluid bag).

The design of this study was very similar to the one used in "Assessment of the Change in State of Health in Reference to Different Postural Support Systems: Outcome of Research."

Subjects were submitted to a postural assessment, tried each cushion for one week and filled SF-12 and self-satisfaction questionnaires. Boditrak and FSA system were used to collect data for pressure-mapping.

Key results

b

Table 7 -
Average pressure exercised on each cushion in static and dynamic position.

- **The following tables resume the main results achieved by this study.**

	Roho Contour Select (mean ± SD)	Invacare Matrx Libra (mean ± SD)	Jay Balance (mean ± SD)
Static			
Mean (mmHg)	41.33 ± 12.2	39.58 ± 11.743	39.83 ± 16.348
COP (cm)	22.67 ± 1.614	22.92 ± 2.151	2 ± 1.706
CVP (cm)	24.42 ± 4.641	26.67 ± 4.499	24.83 ± 4.802
Dynamic			
Mean (mmHg)	51.08 ± 15.547	49.08 ± 15.180	45.08 ± 12.501
COP (cm)	22.17 ± 1.528	23.17 ± 1.850	23 ± 2.523
CVP (cm)	24.92 ± 4.738	26.33 ± 4.141	25.5 ± 4.964

Table 8 -
Postural assessment results; percentage of how close each body segment was to the ideal posture.

	Roho Contour Select	Invacare Matrx Libra	Jay Balance
Head	91.7%	100%	100%
Shoulders	58.3%	91.7%	83.3%
Torso	50%	66.7%	66.7%
Pelvis	33.3%	50%	66.7%
Lower limbs	83.3%	83.3%	91.7%

Key results

b

Table 9 -
SF-12 Questionnaire results.

SF-12	Roho Contour Select (mean ± SD)	Invacare Matrx Libra (mean ± SD)	Jay Balance (mean ± SD)
PCS (Physical Component Summary)	43.42 (SD 9.10)	45.83 (SD 5)	42.50 (SD 9.4)
MCS (Mental Composite Score)	48.43 (SD 10.06)	56.58 (SD 9.03)	48.67 (SD 9.11)

Table 10 -
Questionnaire results on subjects' satisfaction on using the cushion.

	Roho Contour Select (mean ± SD)	Invacare Matrx Libra (mean ± SD)	Jay Balance (mean ± SD)
Stability	3.08 ± 1.165	4.17 ± 0.937	4 ± 0.853
Temperature	3.75 ± 0.754	4.17 ± 0.937	3.83 ± 1.115
Adaptability to activities	3.50 ± 1.243	3.873 ± 1.267	3.75 ± 1.138
Transfers	3.5 ± 1	4.33 ± 0.651	4.08 ± 1.24
Stability during ADL	3.5 ± 0.905	4.17 ± 0.937	3.92 ± 0.9
Stability in movement	3.5 ± 1	4 ± 0.953	3.83 ± 0.835
Total	**20.83 ± 0.158**	**24.67 ± 0.198**	**23.41 ± 0.t112**

c

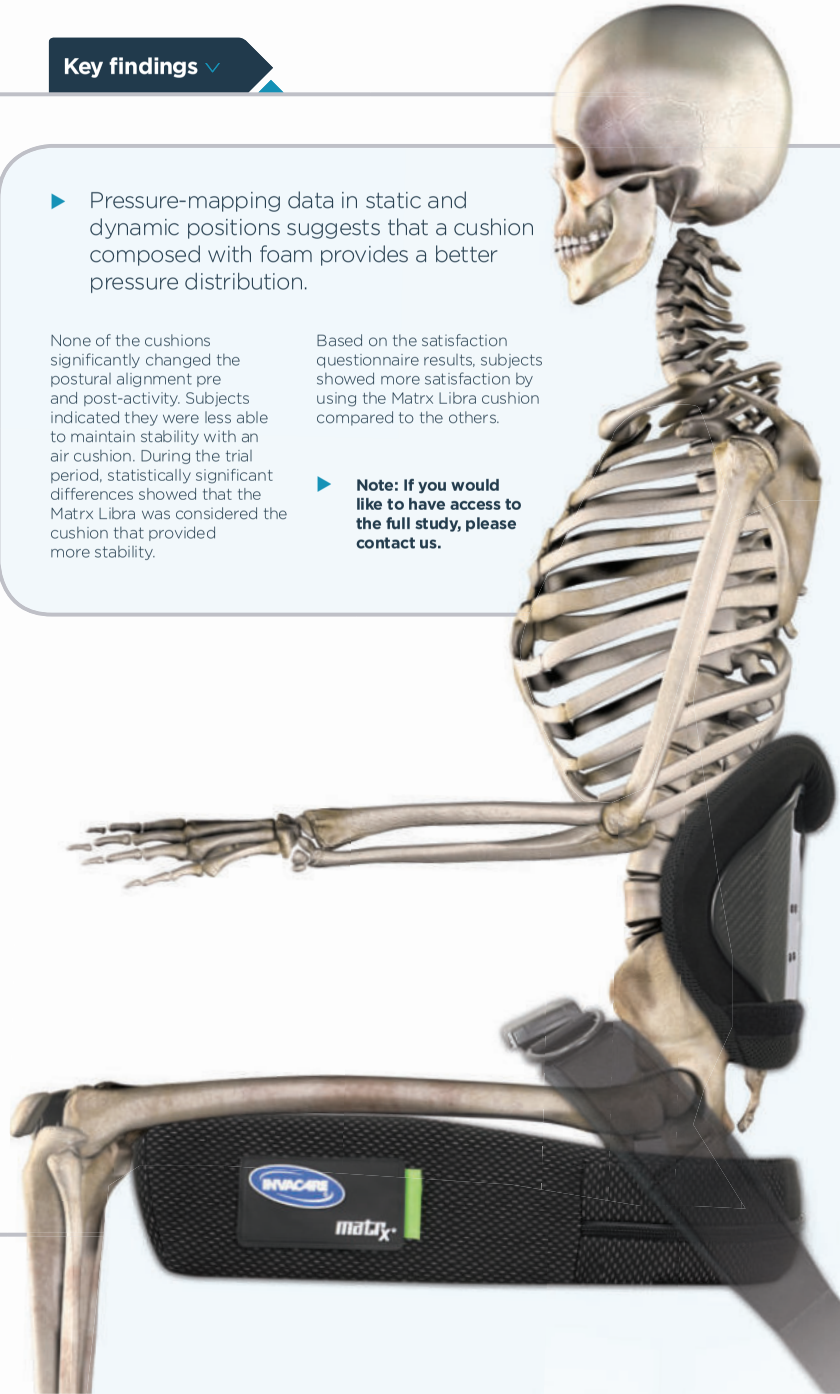
Key findings

- Pressure-mapping data in static and dynamic positions suggests that a cushion composed with foam provides a better pressure distribution.

None of the cushions significantly changed the postural alignment pre and post-activity. Subjects indicated they were less able to maintain stability with an air cushion. During the trial period, statistically significant differences showed that the Matrx Libra was considered the cushion that provided more stability.

Based on the satisfaction questionnaire results, subjects showed more satisfaction by using the Matrx Libra cushion compared to the others.

- **Note: If you would like to have access to the full study, please contact us.**



3

Libra Wheelchair Cushion Testing for PDAC Human Subject Test Adjustable Skin Protection and Positioning

AUTHORS: Miller, G and EC Service, Inc.

DATE: 2014

Study aim and design

a

- Human Subject Pressure Mapping was conducted by an accredited lab – EC Service Inc. – to determine eligibility for Adjustable Skin Protection and Positioning coding (US Medicare).

The subject population for this study included **ten volunteers - three ambulatory and seven paraplegic** (with different injury levels). The test was done under controlled conditions with a BodiTrak pressure mat system (BT 1510 model with FSA software - version 4.1.001, calibrated to 300 mmHg) which was used to collect pressure-mapping data.

The test consisted of a comparison between a reference foam, a new Matrx Libra cushion and an aged Matrx Libra cushion.

Two Matrx Libra cushions of each size were provided by the manufacturer and one of each size underwent simulated aging (simulating 18 months of use).

Once the appropriate size cushion was determined for each user, they were adjusted to achieve the best fit possible using accessories when necessary. Subjects were transferred onto the cushion/pressure mat and the technician began recording the data. Each subject was tested on the new and aged cushions, and on the reference foam (five trials with each).

After data collection was complete, the following calculations were done:

- **Peak Pressure Index** - the average of the cells with the greatest sum of pressures
- **Peak Pressure** - the highest recorded reading on the pressure map or within a specified zone
- **Average Pressure** - the average of the entire pressure map or zone for sensors with a pressure greater than or equal to 5 mmHg
- **Contact Area** - the area with pressure readings greater than or equal to 10 mmHg

Key results

b

Table 11 - Peak Pressure Index (mmHg)

- **For each Peak Pressure Index (PPI) test, the cell in the sacro-ischial zone with the highest pressure was identified**, the greatest sum of pressures in the identified and adjacent cells were determined and the average of the five trials was calculated for each subject.

The average PPI on the test cushion is divided by the average PPI on the reference foam cushion and multiplied by 100 to give the percentage comparison of peak pressure indexes.

For adjustable/skin protection cushions, the comparative values must be less than 85%. Results showed that the Matrx Libra achieved a comparative pressure of 76.7% when new and 74.8% after aging.

Volunteer	New	Aged	Reference Foam
1	197.7 ± 25.5	181.1 ± 14.1	221.5 ± 22.4
2	111.1 ± 2.1	111.2 ± 8.4	150.1 ±13.8
3	138.7 ± 9.2	118.7 ± 8.4	182.5 ± 19.7
4	90.6 ± 13.6	92.7 ± 3.8	140.0 ± 41.0
5	136.9 ± 12.7	143.4 ± 18.2	200.8 ± 26.6
6	103.1 ± 4.6	94.0 ± 5.9	123.2 ± 14.8
7	103.9 ± 5.5	116.4 ± 12.4	149.0 ± 10.7
8	80.2 ± 4.2	91.4 ± 12.1	83.1 ± 3.0
9	79.7 ± 7.6	84.1 ± 3.2	96.9 ± 6.6
10	118.1 ± 7.6	97.7 ± 13.5	165.4 ± 30.3
AVERAGE	**116.0**	**113.1**	**151.2**
% DIFFERENCE	76.7%	74.8%	

Key results

b

Table 12 - Peak Pressure (mmHg) per subject

Volunteer	New	Aged	Reference Foam
1	278.8 ± 37.9	226.6 ± 22.4	287.7 ± 24.2
2	120.4 ± 5.6	123.3 ± 8.7	168.3 ± 5.6
3	163.3 ± 13.3	158.3 ± 23.3	257.8 ± 29.3
4	112.1 ± 9.9	111.5 ± 4.4	197.0 ± 78.3
5	165.0 ± 21.1	205.1 ± 15.8	267.7 ± 39.4
6	123.4 ± 11.9	116.5 ± 12.0	175.2 ± 61.3
7	133.6 ± 10.0	146.7 ± 18.1	163.7 ± 10.4
8	98.9 ± 8.6	105.0 ± 11.8	107.1 ± 4.3
9	88.6 ± 7.9	96.2 ± 10.8	102.3 ± 7.2
10	149.0 ± 13.7	110.66 ± 11.4	209.6 ± 37.2

Key conclusion

c

- **This study has demonstrated that a Matrx Libra cushion performs better than standard reference foam.** Results have also demonstrated that Matrx Libra cushion passed the requirements for an adjustable skin protection and positioning cushion with a comparative pressure of 76.7% when new and 74.8% after ageing.
- **Note: If you would like to have access to the full study, please contact us.**

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