



Physiological, performance, training and technique characteristics of an Olympic champion double-sculls crew

Nikola Bralić

General info

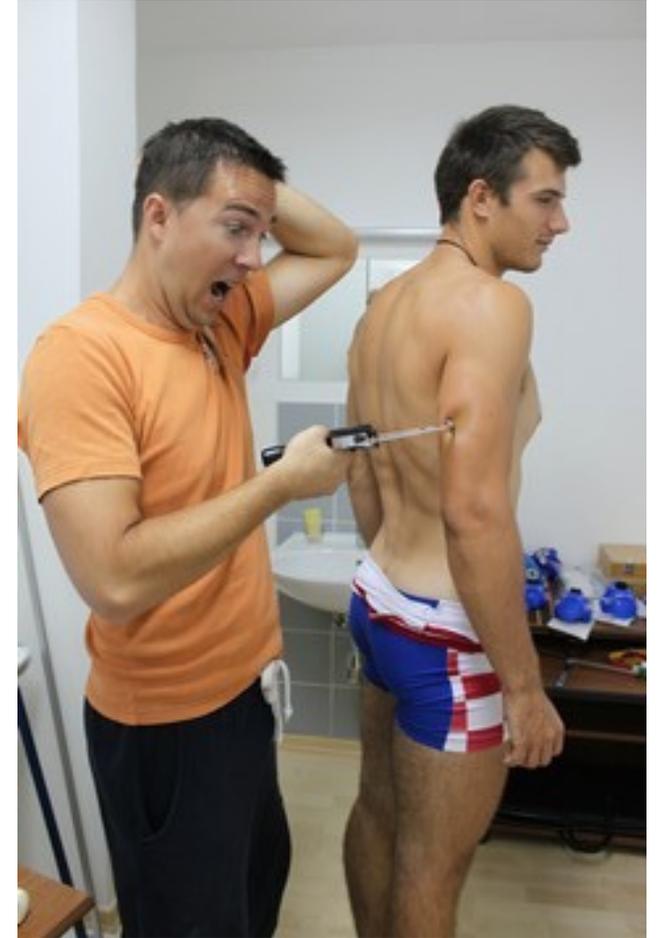
- Started rowing in 1999 (Valent) and 2000 (Martin) at 11 years of age
 - Practiced a variety of sports prior to joining the rowing club (soccer, water polo..)
- Members of the RC Mladost Zagreb since the beginning of their rowing careers; worked with four coaches:
 - Pavle Mikulić (1999-2000)
 - Toma Grego (2000-2003)
 - Darko Mikšić (2003-2007)
 - Nikola Bralić (since 2007)

Achievements of note

- As junior rowers: 2nd at WJC (2x, Valent); 3rd at WJC (1x, Martin)
- As senior rowers (together):
 - 2 times World U23 Champions (4x)
 - 3 time World Cup winners (2 times in 4x and 2 times in 2x)
 - 4 times World Champions (2 times both in 4x and in 2x)
 - **Olympic Champions in 2016 (2x)** and vice-champions in 2012 (4x)
 - Currently unbeaten in 2x in an official race for three seasons straight (29 races in a row)

Their frame

- Valent: 188 cm; 92-94 kg (off-season),
92 kg (in-season); body fat \approx 9-10%
- Martin: 188 cm; 95-97 kg (both off- and in-season);
body fat \approx 12-13%



Engines inside their bodies

- Routinely tested at the University of Zagreb *Faculty of Kinesiology* (Zagreb, Croatia) since 2005
- We use a continuous ramp-wise test on a rowing ergometer (3 min at 150 W followed by 25W/min increments until exhaustion)
- Data is used for progress evaluation as well as for better control of training intensity (especially during the winter period with a lot of ergo work)



VIDEO0250

Engines inside their bodies

Parameter – MAXIMAL VALUES	Measurement unit	<i>Martin (winter 2015)</i>	<i>Valent (winter 2015)</i>
Maximal oxygen uptake	lO ₂ /min	7,11	7,06
Maximal oxygen uptake	mlO ₂ /kg/min	74,8	74,4
Maximal heart rate	bts/min	186	181
Maximal oxygen pulse	mlO ₂	38,4	39,2
Maximal ventilation	l/min	243,6	228,7
Power output at VO ₂ max	W	512,5	512,5
Maximal sustained power output	W	525	537,5

Engines inside their bodies

Parameter – VALUES CORRESPONDING TO ANAEROBIC THRESHOLD*	Measurement unit	<i>Martin (winter 2015)</i>	<i>Valent (winter 2015)</i>
Oxygen uptake	lO ₂ /min	6,27	5,99
Oxygen uptake as pct of max	%	89	85
Heart rate	bts/min	175	169
Heart rate as pct of max	%	94	93
Power output	W	410	380
Velocity (erg)	t/500m	~1:35,0	~1:37,2

*As estimated using ventilatory parameters

Valent – training zones

<i>Zone intenziteta - VESLANJE</i>	<i>FS (otk/min) i brzina (t/500m)</i>
<i>Regeneracijska zona (A0)</i>	<i><127 (>2:05)</i>
<i>Zona ekstenzivnog aerobnog treninga (A1)</i>	<i>127 – 154 (2:04 – 1:45)</i>
<i>Zona intenzivnog aerobnog treninga (A2)</i>	<i>155 – 167 (1:44 – 1:39)</i>
<i>Zona intenzivnog aer. treninga - zona praga (Ap)</i>	<i>168 - 172 (1:38 – 1:36)</i>
<i>Zona maksimalnog primitka kisika (VO₂max)</i>	<i>>172 (<1:35)</i>

Martin – training zones

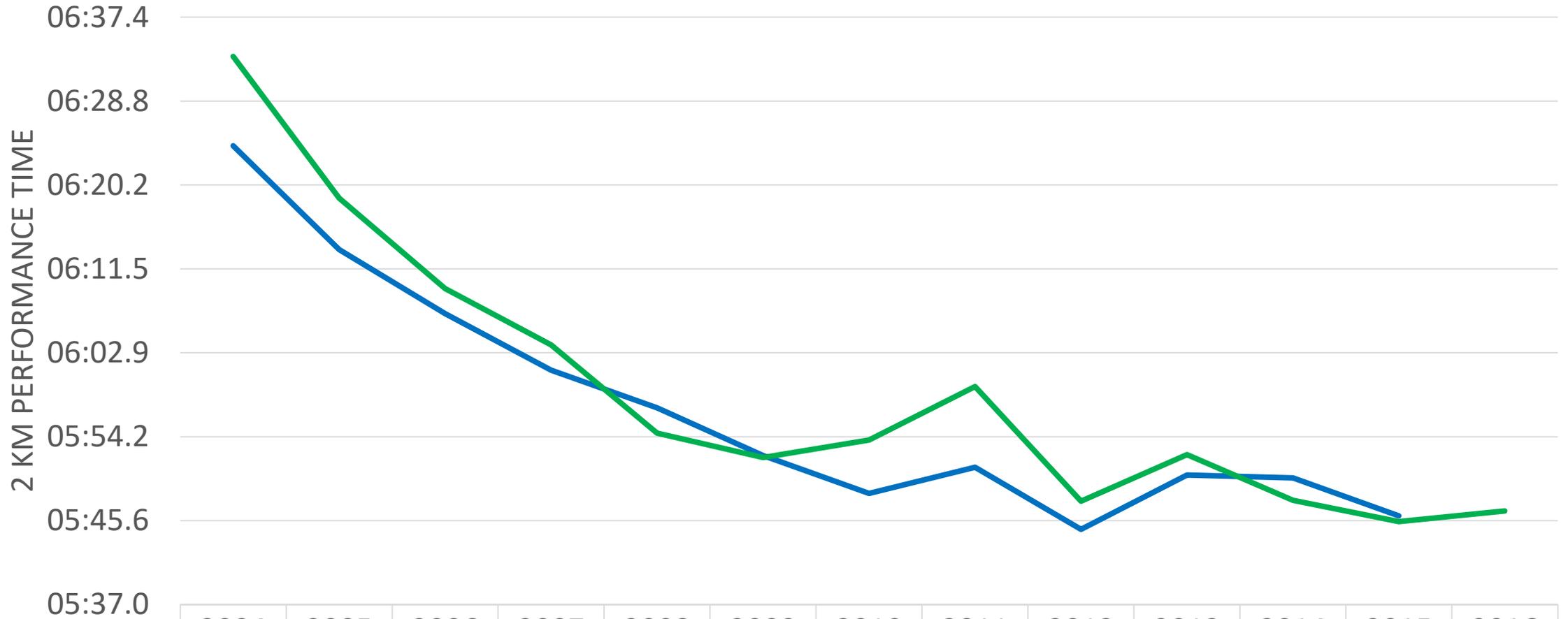
<i>Zone intenziteta - VESLANJE</i>	<i>FS (otk/min) i brzina (t/500m)</i>
<i>Regeneracijska zona (A0)</i>	<i><130 (<2:00)</i>
<i>Zona ekstenzivnog aerobnog treninga (A1)</i>	<i>130 – 159 (2:00 – 1:45)</i>
<i>Zona intenzivnog aerobnog treninga (A2)</i>	<i>160 – 172 (1:44 – 1:38)</i>
<i>Zona intenzivnog aer. treninga - zona praga (Ap)</i>	<i>173 - 178 (1:37 – 1:34)</i>
<i>Zona maksimalnog primitka kisika (VO₂max)</i>	<i>>179 (<1:34)</i>

Performance data

- For performance capacity evaluation, we routinely use:
 - Physiological testing (Nov or Dec)
 - 6 km (Dec + Feb) and 2 km (Feb/Mar) ergometer tests
 - Erg on slides used since 2012
 - On-water tests:
 - 250 m all-out (flying start)
 - 500 m (stroke rate set at 36)
 - 500 m (start)
 - 750 m (stroke rate set at 34)
 - 1000 m (flying start; stroke rate set at 36)
 - 8 km



Progression of 2 km ergometer performance times



05:37.0

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Valent	06:24.	06:13.	06:06.	06:01.	05:57.	05:52.	05:48.	05:51.	05:44.	05:50.	05:50.	05:46.	
Martin	06:33.	06:18.	06:09.	06:03.	05:54.	05:52.	05:53.	05:59.	05:47.	05:52.	05:47.	05:45.	05:46.

05:45.6

05:45.6

05:54.2

06:02.9

06:11.5

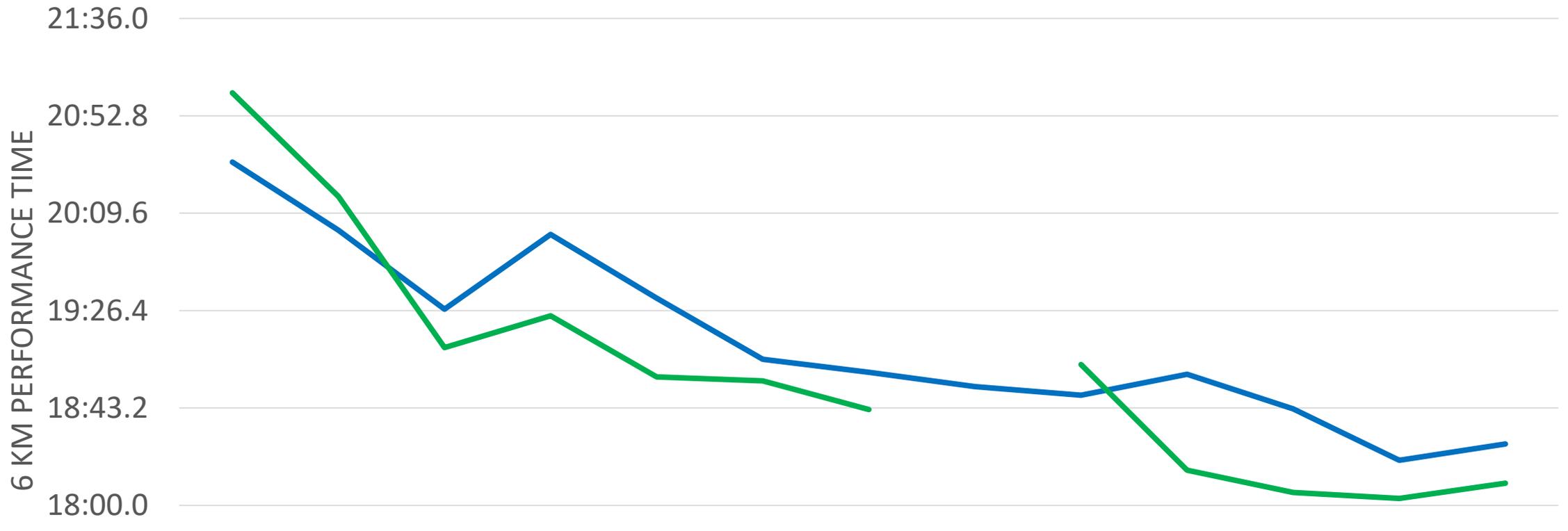
06:20.2

06:28.8

06:37.4

2 KM PERFORMANCE TIME

Progression of 6 km ergometer performance times



17:16.8

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
— Valent	20:32.	20:02.	19:27.	20:00.	19:31.	19:04.	18:59.	18:52.	18:48.	18:58.	18:42.	18:20.	18:27.
— Martin	21:03.	20:17.	19:10.	19:24.	18:57.	18:55.	18:42.		19:02.	18:15.	18:05.	18:03.	18:09.

On the top for so long. How?

- In my opinion:
 1. Superior rowing technique
 2. Excellent endurance capacity
 3. Mental preparation (strong mental stability)
 4. Sporting life

Rowing technique

Specifics of their rowing technique:

- Very stable boat; minimal rotations about the longitudinal axis of the boat (regardless of the weather conditions)
- Perfect synchronizacion
- Very precise catch and release (minimal loss of the propulsion force – minimal oar slip at catch and finish)
- Fast drive



Developing endurance capacity

- Means:
 - On-water rowing
 - Tank rowing
 - Ergometer rowing
 - Running (outdoors)
 - Cross country skiing
 - Cycling (outdoors)
 - Indoors: various simulators (elliptical machine, cycle ergometer, ski ergometer, kayak ergometer)

Developing endurance capacity

- Training load:
 - 8 - 9 sessions per week (average)
 - Basic extensive endurance 2 hours per training session (cross country skiing, cycling and mix training) 3 - 4 hours per training 8 sessions off-season, 6 in-season

Intensive endurance ½ hours and up per training session
1 sessions off-season, 2 - 3 in-season

Training types we typically use (training zones)

Load zone (level)		Strokes per minute	Boat speed 250 m/sec	HR
International	We call it			
U - 2	A0 (recovery)	18 - 20	59 - 60	130 - 150
	A1 (aerobic extensive endurance)	20 - 22	56 - 58	
U - 1	A2 (aerobic intensive endurance)	23 - 25	53 - 56	140 - 160
AT	AP (threshold training)	25 - 27	50 - 53	160- 175
Tranaportation	VO2max	27 - 30	48 - 50	170 - 190
	VO2max	30 - 34	46 -48	
	R (race)	34 - 42	41 - 46	
Max.	Lactate/Alactate	Submax/max	39 - 43	

Developing strength

- Weightlifting
 - Fitness machine
 - Crossfit
 - With resistance (1/1 rowing, water resistance, max. drive etc.)
-
- Training load:
 - 3 sessions per week (average)

Dilemma at this stage of their careers

- Maintaining the motivation for training at the high level after so many years at the top... what to do?
- Options:
 - Take a break completely for a season
 - Opt for a lower level of performance and results (not good for self confidence long term)
 - Try sweep oar rowing and enter a new realm
- We opt to enter a new realm (for a full season or for a half-season, we'll see)

My training philosophy – random thoughts

- Be persistent! Be stubborn! Be focussed!
- Be fair with your athlete!
- Go for the shortest and most efficient routes of improving certain aspects (can't go to college if no primary school is finished)
- Obey teaching principles (from easier to more difficult, from slower to faster, from known to unknown etc.)
- Be up-to-date with the development of technique and technology (equipment, training etc.)