

# The Orbel™ Advantage



**Changing the Hand Hygiene Compliance  
Paradigm**

## Introduction: The complexity of compliance

There are an estimated 2 million hospital associated infections per year globally, affecting 10% of hospital patients (Haas & Larson 2008; WHO 2009). Much work has been done trying to identify what kind of training is needed for healthcare workers in teaching them to have good hand hygiene compliance. In the last twenty or so years over 100 scientific articles on clinical or behavioral studies have been published on the subject (Mah et al. 2008; WHO 2009; Huis et al. 2012). When compliance can be increased, then infection rate reductions can be realized (Mestre et al. 2012; Michaels & Griffith 2013). One key is to eliminate reasons for non-compliance such as lack of time or skin irritation (CDC 2002; WHO 2009; Mortell 2012). The latter predicated the introduction of alcohol hand sanitizer into full use in healthcare environments in 2002 (CDC 2002). And while nosocomial infection rates have dropped, there is still a general lack of compliance that is still only seen to be around 50% (Gould et al. 2010; IHI 2011).

In various meta-analysis of hand hygiene programs using alcohol hand sanitizers delivering some infection rate reductions, a complex set of educational, motivational and facility interventions are required to achieve the successes shown (Pittet 2003; Stout et al. 2007; Michaels & Griffith 2013). With a glimpse of what is possible in terms of rate reductions with compliance increases, many researchers have delved into human psychology and models of cognitive behavior in trying to enact permanent change (Kretzer & Larson 1998; Erasmus et al. 2009). Using various complex models to intellectualize learning and behavior some experts in the field are coming to the conclusion that it is not a matter of learning or motivation (De Wandel et al. 2010; Boscart et al. 2012; Huis et al. 2012). All healthcare workers seem to have the requisite knowledge and are motivated to carry out hand hygiene when required but are unable to do so because of high workloads (Garus-Pakowska 2011) and poor accessibility of hand hygiene supplies (Barrett & Randle 2008; Jang et al. 2010; Knoll et al. 2010). This lack of compliance is also at the junction of the theory-practice-ethics gap (Mortell 2012) where lack of time is often a reason given for lack of compliance (Chaberny et al. 2009; Mathai et al. 2011).

In the early 1990's working in the food sciences and trying to get food workers to wash their hands, H.C. Emory did a significant amount of research into trying to change hand washing habits in food service (Emory 1990). Realizing the common challenge faced by infection control practitioners in healthcare and sanitarians in food safety, he stated that, "...**supervision and ease of using facilities were more important than education**". Translated to an actionable plan for healthcare applications, point-of-care hand sanitizer dispensers have been advocated to improve compliance (Suresh & Cahill 2007; WHO 2009; Thomas et al. 2009; Levchenko et al. 2011). Unfortunately, bottles carried in pockets or difficult-to-use belt units do not always translate into their automatic use by HCW (Haas & Larson 2008; Kendall et al. 2012).

Likewise the complex behavioral model approach to changing behavior has been of little help and has caused healthcare facilities to devote more and more time to education and training of HCWs with poor return-on-investment (Backman et al. 2008; Huis et al. 2012). **The Orbel™ system is unique and a radical departure**

from this up until now standard approach to training and it provides a POC unit HCW will use. The Orbel™ technology borrows a page from neuroscience converting the hand hygiene process from something that is normally highly attention and time demanding for the brain into an automatic process that can best be described as muscle memory (Rhodes et al. 2004; De Kleine & Verwey 2009).

## Orbel™ Advantage in Healthcare Delivery

### A. The Electric Mind and Orbel™ Motor Chunks

- 1. The Orbel™ improves focus on medical tasks with automatic delivery of hand sanitizer to hand upon visual cue; the “need to sanitize”.** Normally, realization that hands must be sanitized prior to a performing a medical procedure involves a 4-component process, transforming observation to action. Neuroscientists have found that to achieve conscious action it usually takes continuous monitoring and feedback (Andersen & Cul 2009). This occurs within a constant temporal dynamic via a complex set of neurons involved in planning, decision-making, forward state estimation and relative-coordinate representations in the motor planning areas of the brain (Andersen & Cul 2009). Also involved are three different spatial memory neurons located in the hippocampus that define room borders and relative triangulated position of the dispenser as well as pin-point location (Shrager et al. 2007; Gaskin 2008; Dupret et al. 2013). It is in this multi-stage process that it would appear (based on poor compliance figures) at least **50 % of the time a decision switch is flipped in the brain (consciously or unconsciously) over-riding the hand hygiene directive.** Neuroscientists are aware of many situations where one directive is overridden by competing demands for action (Cisek et al. 2007).
- 2. With the Orbel™ unit, neural pathways are reinforced and habits are created by stimulation of the hand with tactile multi-roller balls and cooling gel.** Through repetition, a complex process is transformed into an automatic one via this tactile-kinesthetic stimulus. In many other real world applications from factory work to sports and dance, simple spatial and temporal patterns of muscle activation are converted from a single neural command signal into “muscle memory” encoded as “motor chunks” (Cisek et al. 2007; Brown & Parsons 2008; De Kleine & Verwey 2009). What actually happens according to neuroscientists is that the movements become thoroughly mapped in the brain, creating a "motor chunk" shorthand between thinking and doing.
- 3. Orbel™ use, once trained as a sensorimotor task, results in storage of motor and somatosensory representation (for need to sanitize hands) in the motor and somatosensory cortices of the brain** respectively, and they are recalled immediately upon observation of need for action as has been shown in related applications (Cisek et al. 2007; Hardwick et al. 2013). When we use a tool such as the Orbel™, the representation of multisensory peri-personal space is extended and visual-tactile interaction is strengthened

(Holmes & Spence 2004). The tactile stimulation and feedback with delivery of sanitizer to the hand and fingers makes it easier to represent the simultaneous need for and execution of a hand hygiene event independent of motor planning or an associated action.

Under standard hand hygiene compliance behavior the temporal dynamics require a series of decision-making steps such as: 1) “what do I put down and where?”, 2) “where is the nearest dispenser?”, 3) “will the patient move requiring re-positioning; etc.?” With the Orbel™ there is no need for continuous decision logic monitoring and instead input modality is translated into immediate action, leaving mental resources free for concurrent facilitation of the medical procedure requiring hand hygiene in the first place. This allows for successful accomplishment of the medical task without contamination or compromise of hygienic integrity

## B. Positional Logic

4. **The Orbel™ unit becomes an extension of the HCW’s hand, with its Zylast XP formulation capable of delivering a 99.99% kill rate** within 15 seconds of application (Shintre et al. 2006; Shintre et al. 2007; Zylast XP). The Orbel™ worn by HCWs is as recommended, ideally positioned between the contaminated hand and the object, device, patient or procedure at risk of being contaminated (Maury et al. 2000; Sax et al. 2007; Rupp et al. 2008; Scheithauer et al. 2012; ACSQH 2012). The Orbel™ unit works on the same principle as positive pressure isolation rooms but with much greater pressure differentials in order to deliver sanitizer to hands (Marshall et al. 1996; Rice et al. 2001). In addition to the positive pressure, laminar flow of sanitizer is extruded from around the side of the ball first contacted by the fingers and doctored off the ball as it rotates back into the unit.
5. **The Orbel™ unit sanitizes hand areas linked to cross-contamination.** The most critical parts of the hand are the fingertips, index finger and thumb; those areas normally missed with hand washing and typical sanitizer use that delivers sanitizer to the palm (Taylor 1978; MacDonald et al. 2006). Standard alcohol dispensers tend to deliver sanitizer into the palm of the hand with palms rubbed together first. With Orbel™ use, fingertips are coated first with lesser emphasis on palms. With fingertip application it is possible to use the thumb to roll Orbel™ sanitizer under the fingernails; an overlooked habitat for potential pathogens (Leyden et al. 1989; Lin et al. 2004).
6. **As immediate accessibility is the strongest predictor of compliance** (Traore et al. 2007; WHO 2009; Kendall et al. 2012), the Orbel™ unit is ever-present and a silent witness to those discrete events where, because of circumstances such as high workloads, hands become contaminated and life can sometimes hang in the balance



■ Areas most frequently missed during hand washing  
 ■ Less frequently missed  
 ■ Not missed

(Adapted from Taylor L. (1978), An evaluation of hand washing techniques - I, Nursing Times, 12 January, pp 54-58)

(Beggs et al. 2009; Garus-Pakowska 2011). Here at this critical point, the race against time (as lack of time is often cited for non-compliance) is between the ever-present Orbel™ and the dispensers hanging on the wall or the end of the bed (perhaps only 3 steps away) that don't get used (Chaberny et al. 2009).

- 7. Hand hygiene is often biased against what are perceived as low-risk procedures.** Healthcare workers are not always aware that bacterial spread can occur even during activities perceived as low risk such as touching ward computers, case notes, door handles and other areas where immediate accessibility to hand hygiene is critical (Smith et al. 2012; FitzGerald et al. 2013).

### C. Compliance Enhancement

- 8. While the Orbel™ will significantly increase compliance, it doesn't take much of a hand hygiene rate increase to reduce infection rates** because these rates are driven by those HCW who contact patients most and for various reasons wash or sanitize hands least (Cummings et al. 2010). These are HCW in the bottom level of hand hygiene compliance (Knoll et al. 2010). By making hygiene exceptionally easy in these situations, the Orbel's most significant impact is not in increasing average compliance (a good thing) but more importantly bringing up the bottom levels of compliance where the greatest risk of transmission exists (Beggs et al. 2009). Therefore the Orbel™ dispenser's most significant impact will be on habitual non-compliers where hand hygiene is most needed (Pittet et al. 2000; Michaels & Griffith 2013).

**Orbel™ compliance monitoring is intuitive** and based on positive stimuli behavior reinforcement. HCW initials can be applied to each Orbel™ unit when distributed at the beginning of the workday and turned in empty at the end of the shift. With 60 doses of hand sanitizer, interrupted by frequent hand washing (20% of total), an ideal compliance level is achieved when used as an adjunct to wall mounted dispensers (Levchenko et al. 2011; Sicoli et al. 2012). With HCW initials on each unit and turned in empty, compliance is assured and can be recorded if desired.

See section 14. (Hand Hygiene Compliance Monitoring Made Easy) for details obtaining 60% to 75% compliance.

- 9. Orbel™ compliance is not complex, expensive or embarrassing,** as workers will immediately learn to use up the gel pack by end of shift. The positive reinforcement provided by the Orbel™ unit is a powerful and effective tool to help change HCW behavior; preferable to negative reinforcement and punishment. Many hand hygiene monitoring approaches have been proposed utilizing systems that vary in complexity and are either labor intensive or expensive (Haas & Larson 2007; Boyce 2008; Polgreen et al. 2010; Cheng et al 2011). The Orbel™ is so effective at compliance improvement and easy to monitor, that neither HCW nor the facility need to be embarrassed by negative compliance records.

## D. Patient-centered hand hygiene

The patient zone, considered to be areas actively touched by patients, has been found to be a source of HAIs often being spread by the hands of healthcare workers (HCW) or by the patient themselves (WHO 2009; Thom et al. 2011; Landers et al. 2012; Moore et al. 2013). It is often from this zone that patients end up infecting themselves by self-inoculation (Moore et al. 2013). Bedrails are a recognized hotspot where HCWs often pick up and transfer potential pathogens to other patients and for this reason are considered a good place to mount dispensers for HCWs (Giannitsioti et al. 2009). By providing patients with an Orbel™ unit for tray table and attachment to bedrails as recommended, the risk of transmission from patient to patient and by self-inoculation can be reduced (Bischoff et al. 2000; IHI 2011; Moore et al. 2013).

## E. Delivering Infection Rate Reductions

- 10. Portable Hand antiseptics units like the Orbel™ have shown to significantly increase compliance rates and decrease HAIs.** In studies using body-worn hand antiseptics dispensers, hand hygiene compliance has been seen to increase dramatically (Koff et al. 2009; Koff et al. 2011; Petty 2013). Activated by one hand they have been shown to decrease HAI rates by around an additional 40% beyond the reduction benefits seen by using wall mounted hand sanitizer dispensers (Koff et al. 2009; Koff et al. 2011).
- 11. Table 1 shows the results from studies where introduction of alcohol based hand sanitizer (ABHS) improved compliance and reduced infection rates.** The first 8 studies show infection rate reductions compared to almost exclusive reliance on hand washing with soap versus incorporation of ABHS (& training). The last 2 studies show results where hand antiseptic was already in use but portable point-of-care units like the Orbel™ were used. The data for infection rate reductions versus compliance increases is in **Figure 1**.
- 12. The Orbel™ Advantage:** Only high compliance increases are capable of delivering the highest reduction of infection rates related to poor hand hygiene. This is possible with personal POC dispensers like the Orbel™ when worn by HCW and used at high frequency (60 times /day) used as an adjunct to wall mounted ABHS dispensers following the WHO “5 Moment” guidelines (Sax et al. 2007; WHO 2009).

## F. Additional Dividends: Return-on-Investment

- 13. Return on Investment figures are provided in Table 2** for various analyses including studies presented here. In addition to the data provided here, in a study performed by Cummings and collaborators at Duke University Medical Center, it was determined that every extra 1.0% increase in hand hygiene compliance will cause a saving of \$39,650 to a 200-bed hospital (Cummings et al. 2010).

**Table 1: Hand Sanitizer Compliance Increases & Infection Rate Reductions**

Study Reference	Study Location	% Compliance Increase	% Infection Rate Reduction <sup>1</sup>	Infection Types Monitored <sup>2</sup>
<b>Use of Alcohol Hand Antiseptic in Wall Mounted Dispensers versus Standard Hand Washing with Soap (Bland or AM) Combined with Rinsing &amp; Drying</b>				
Pittet et al. 2000	Switzerland	40	41	MRSA, BSI, OA
Hilburn et al. 2003	US	40	36	UTI
MacDonald et al. 2004	UK	60	52	MRSA
Lam et al. 2004	China (HK)	70	60	BSI, RTI, OA
Aragon et al. 2005	US	10	15	MRSA, VRE
Harrington et al. 2007	Australia	30	40	MRSA
Nguyen et al. 2008	Vietnam	200	84	OA
Lederer et al. 2009	US	80	54	MRSA
<b>Use of Orbel™ Type Portable Point-of-Care Hand Antiseptic Dispensing Devices Worn by HCW vs. Standard Wall Mounted Hand Sanitizer Dispensers</b>				
Koff et al. 2009	US	170	78	OA
Koff et al. 2011	US	40	44	BSI, RTI

**14. Hand Hygiene Compliance Monitoring Made Easy:** In the WHO alcohol-based hand rub planning and cost program (WHO 2010) data is provided laying out various hand hygiene compliance program around POC Orbel™ Zylast™ XP dispenser usage. It suggests that the maximum number of opportunities for hand hygiene (HH) can range from 8 per hour per HCW to approximately 22 per hour per HCW in critical care areas. This fits in well with the data provided from other sources regarding hand hygiene opportunities per care hour (Sicoli et al. 2012). It also indicated that in an 8-hour shift, HCW probably only provide care for about 6 of those hours. A rule of thumb on hand washing frequency versus hand sanitizer usage has established hand washing as consisting of 20% of all events (WHO 2009). In terms of compliance level attainment, the WHO document suggests that 100% hand hygiene compliance is unrealistic with 60% compliance being an upper limit ceiling in several studies. That said, Orbel™ use presents a different paradigm that should be capable of increasing compliance considerably with higher compliance rates (75%) even easier to attain where low frequency

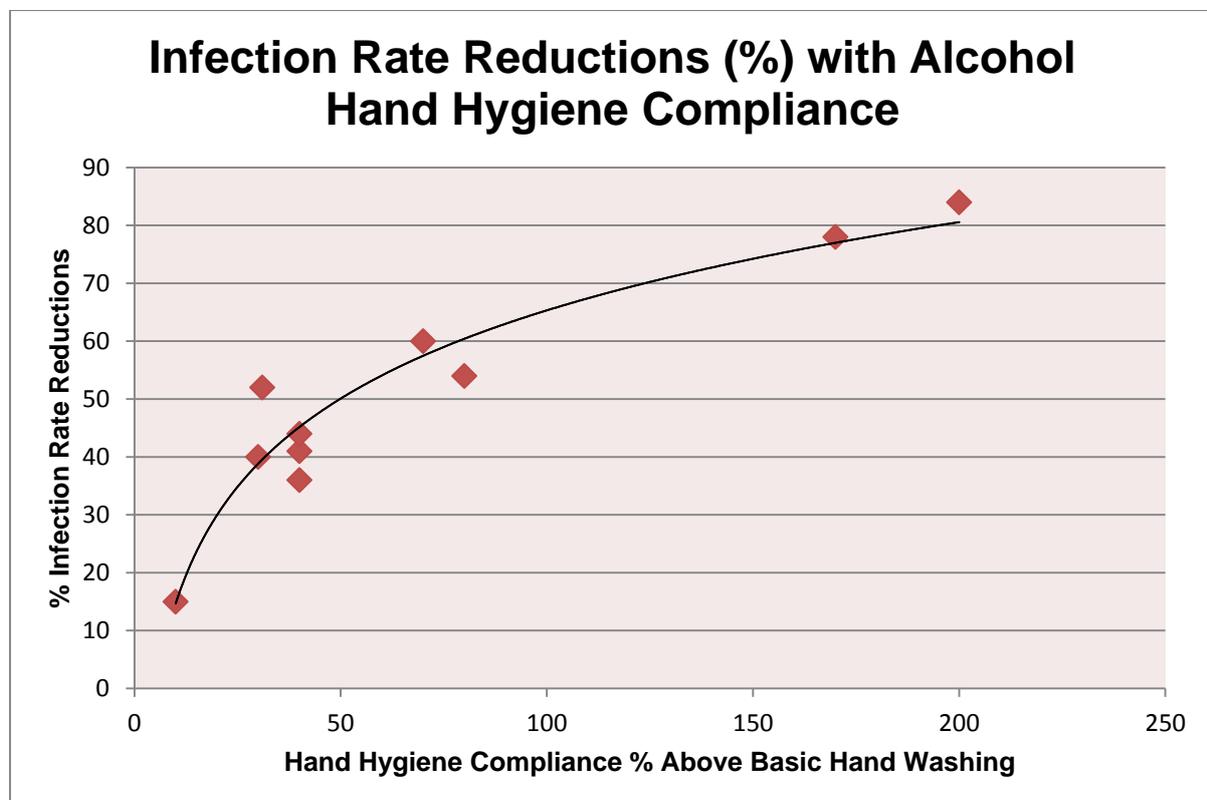
<sup>1</sup> Compliance increase beyond standard hand washing based on observation or AHS usage #s.

<sup>2</sup> MRSA = Methicillin Resistant *S. aureus*; VRE = Vancomycin Resistant Enterococci; BSI = Blood Stream Infection; RTI = Respiratory Tract Infection; UTI = Urinary Tract Infections; OA = Overall.

opportunities exist. From this information the following table was created identifying how the Orbel™ compliance scheme would work. Each Orbel™ unit is capable of delivering 60 1 mL doses of hand rub.

What can be concluded from this analysis is that to achieve 60% to 75% compliance at the high frequencies (16 to 24 events per hour), one 60mL Orbel™ unit per day per HCW supplemented by use of wall mounted sanitizer provides a perfect compliance system. At the lower frequency levels (8 to 12 events per hour) compliance targets would dictate HCW use one 60mL Orbel™ every two (2) days. Units are labeled with HCW initials (with marker) when issued and checked off a compliance list when returned empty.

**Figure 1. Compliance Increases & Infection Rates are Reduced**



**Table 2: Return-on-Investment**

Healthcare Associated Infections	Infection (Interventions)	ROI	Source
Consensus Calculations	HH & Other Interventions	1:17	Haley 1986, MMWR 1992
Consensus Calculations	HH & Other Interventions	1:9	Ragowski et al. 2002
Meta-analysis 38 Studies	HH & Other Interventions	1:8.5	Michaels et al. 2003
Hospital Cost Avoidance Trial	Alcohol Hand Sanitizer	1:54	Hilburn et al. 2003
Ward Cost Savings	Alcohol Hand Sanitizer	1:9.3	MacDonald et al. 2004
Hospital Wide Savings	Alcohol Hand Sanitizer	1:19.8	MacDonald et al. 2004

**Table 3: HH Compliance Rates of 60% to 75% by use of an Orbel™ Unit per Day (2 Days)**

HH Event s/Hr.	Total HH Events/8 Hr. Shift	Total HH Events in 6 Hrs. of 8 Hr. Shift	Total HH Events /Shift with <b>60%</b> Compliance	Hand Wash Events /Shift (20% of Total)	Hand Rub Events /Shift	Total HH Events /Shift with <b>75%</b> Compliance	Hand Wash Events /Shift (20% of Total)	Hand Rub Events /Shift
24	192	144	86	17	69	108	22	86
20	160	120	72	14	57	90	18	72
16	128	96	58	12	46	72	14	58
12	96	72	43	9	34	54	11	43
8	64	48	29	6	23	36	7	29

## Further information

For further information on the Orbel™ hand sanitizer please contact us via our website: [www.dotmed.com/orbel](http://www.dotmed.com/orbel), email us at [sales@dotmed.com](mailto:sales@dotmed.com) or call us at 212 742 1200 ext 297



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